MODEL **CT-1001 Stereo Cassette Player**

HEATHKIT®

ASSEMBLY MANUAL

HEATHKIT

RUSH

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595-1397-03

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During your first 90 days of ownership, any parts which we find are defective, either in materials or workmanship, will be replaced or repaired free of charge. And we'll pay shipping charges to get those parts to you — anywhere in the world.

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Sincerely,

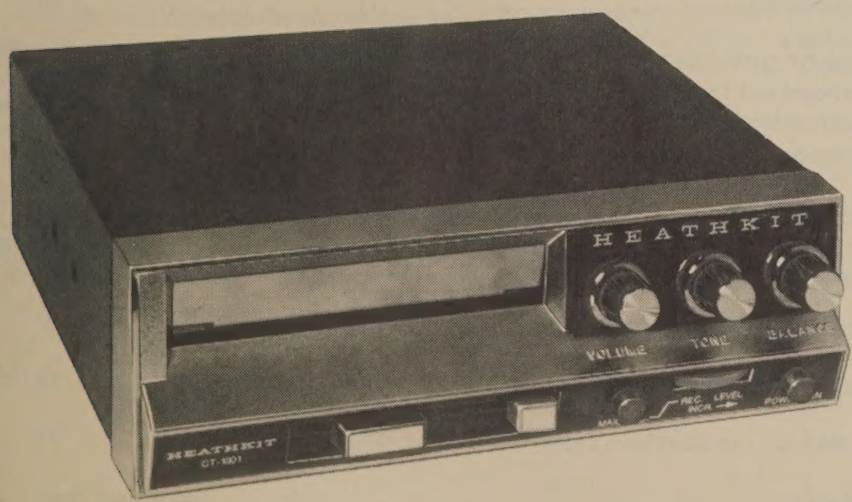
HEATH COMPANY
Benton Harbor, Michigan 49022

Assembly
and
Operation
of the

HEATHKIT™

STEREO CASSETTE PLAYER

MODEL CT-1001



HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

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INTRODUCTION

The Heathkit Modet CT-1001 Stereo Cassette Player, when used with the Heathkit CRA-1000-1 Stereo Power Amplifier, provides high fidelity home music type of entertainment in a car, recreation vehicle, or boat.

The Cassette Player turns on when you insert a cassette cartridge into the unit. An electronic shut-off circuit automatically rejects the cartridge when the tape reaches the end of its travel, if the tape breaks or hangs-up in the cartridge, or power is removed from the Player. An automatic "record interlock" protects prerecorded tapes from being accidentally erased.

Two pushbuttons and four knobs allow you to operate the Cassette Player. A Power On lamp and a Record Level lamp provide visual information at a glance.

Because of a built-in solid-state voltage regulator, a quality long-life motor (that insures a smooth playback operation with a minimum of "wow" and "flutter"), and solid-state components, the Cassette Player will provide you with high performance and a long life.

All the necessary hardware to mount the Cassette Player under the dash or on the transmission hump is supplied in this kit.

Refer to the "Kit Builders Guide" for complete information on unpacking, parts identification; tools, wiring, soldering, and step-by-step assembly procedures.

UNPACKING

The Cassette Player packaging consists of the shipping carton, which contains smaller packages and a number of loose parts. Some of the smaller packages have numbers 1 through 3 stamped on them. After the packages stamped 1 and 2 are removed from the shipping carton, the package stamped 3 and the loose parts in the shipping carton make up pack 3.

You will be directed to open each package as it is needed. Each of the assembly sections of the Manual contains its own Parts List and Step-by-Step Assembly instructions. At the beginning of each Parts List you will be instructed which numbered package to open.

To avoid intermixing parts, do not open any of the parts packages until instructed to do so at the beginning of each Parts List.

PREAMPLIFIER CIRCUIT BOARD

PARTS LIST

Unpack the package marked #1 and check each part against the following list. The key numbers correspond to the numbers on the Preamplifier Circuit Board Parts Pictorial (fold-out from Page 9). Any part that is packaged in an individual envelope with a part number on it should be placed back in its envelope after it is identified until it is called for in a step.

RESISTORS

NOTE: All resistors are 1/2-watt, 10% unless otherwise specified.

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
A1	1-41	1	10 Ω (brown-black-black)	.10
A1	1-54	1	15 Ω, 5% (brown-green-black-gold)	.10
A1	1-153	1	27 Ω (red-violet-black)	.10
A1	1-1	1	47 Ω (yellow-violet-black)	.10
A1	1-123	4	100 Ω, 5% (brown-black-brown-gold)	.10
A1	1-42	1	270 Ω (red-violet-brown)	.10
A1	1-4	1	330 Ω (orange-orange-brown)	.10
A1	1-81	2	1500 Ω, 5% (brown-green-red-gold)	.10
A1	1-93	1	1800 Ω (brown-gray-red)	.10
A1	1-44	2	2200 Ω (red-red-red)	.10

Resistors (cont'd.)

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
A1	1-13	2	2700 Ω (red-violet-red)	.10
A1	1-16	1	4700 Ω (yellow-violet-red)	.10
A1	1-18	2	5600 Ω (green-blue-red)	.10
A1	1-19	2	6800 Ω (blue-gray-red)	.10
A1	1-73	1	8200 Ω (gray-red-red)	.10
A1	1-20	3	10 kΩ (brown-black-orange)	.10
A1	1-109	3	12 kΩ, 5% (brown-red-orange-gold)	.20
A1	1-21	2	15 kΩ (brown-green-orange)	.10
A1	1-162	2	18 kΩ, 5% (brown-gray-orange-gold)	.10
A1	1-22	1	22 kΩ (red-red-orange)	.10
A1	1-25	1	47 kΩ (yellow-violet-orange)	.10
A1	1-60	2	68 kΩ (blue-gray-orange)	.10

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
Resistors (cont'd.)				
A1	1-102	2	82 kΩ (gray-red-orange)	.10
A1	1-104	3	100 kΩ, 5% (brown-black-yellow-gold)	.10
A1	1-167	3	120 kΩ, 5% (brown-red-yellow-gold)	.10
A1	1-30	4	270 kΩ (red-violet-yellow)	.10
A1	4-46	2	1.5 MΩ, 5% (brown-green-green-gold)	.10
CAPACITORS				
Disc				
B1	21-22	1	220 pF	.10
B1	21-140	1	.001 μF	.10
B1	21-36	4	.002 μF	.10
B1	21-95	3	.1 μF	.15
Electrolytic				
B2	25-123	3	2 μF tubular	.40
B3	25-115	10	10 μF vertical	.40
B3	25-116	2	50 μF vertical	.50
B3	25-117	1	100 μF vertical	.50
Mylar*				
B4	27-74	2	.01 μF	.10
B4	27-63	2	.022 μF	.10
Polystyrene				
B5	29-4	2	.0018 μF (1800 pF)	.10

*DuPont Registered Trademark

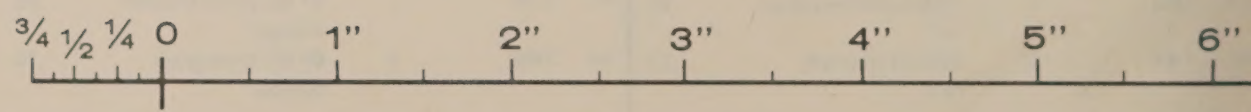
KEY No.	PART No.	PARTS Per Kit	DESCRIPTION	PRIC Each
DIODES-TRANSISTORS				
C1	56-56	2	1N4149 silicon diode	.2

NOTE: Transistors are marked for identification in one of the following four ways.

1. Part number.
2. Type number.
3. Part number and type number.
4. Part number with a type number other than the one listed.

C2	417-91	4	2N5232A transistor	.8
C2	417-94	2	2N3416 transistor	1.0
C2	417-118	3	2N3393 transistor	.4
C2	417-201	3	X29A829 transistor	.5
C2	417-218	2	TZ1160 transistor	.5
MISCELLANEOUS				
D1	45-47	2	RF choke	.3
D2	60-72	1	Slide switch	.4
	85-1114-1	1	Preamplifier circuit board	1.2
	343-16	1	Shielded cable	.1
	344-50	1	Black wire	.0
	344-52	1	Red wire	.0
	390-325	1	Letter label	.1
D3	412-72	2	Lamp assembly	.9
			Solder (Additional 3' rolls of solder #331-6, can be ordered for 15 cents each.)	
PARTS FROM PACK #3				
		1	Manual (See front cover for part number.)	2.0

NOTE: See Page 59 for "Replacement Parts and Price Information."



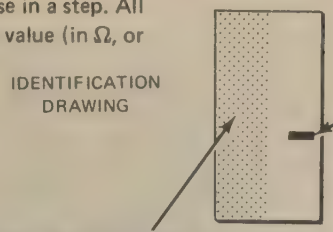
STEP-BY-STEP ASSEMBLY

Before you start to assemble this Kit, be sure to read the "Kit Builders Guide" for complete information on wiring, soldering, and step-by-step assembly procedures.

You will install components on the circuit boards in the following circuit board pictorials. Position all parts as shown. Follow the instructions carefully and read the entire step before performing the operation.

Use 1/2-watt resistors unless directed otherwise in a step. All resistors will be called out by their resistance value (in Ω, or kΩ). The color code will also be given for color-coded resistors. Capacitors will be called out by their type and capacitance value (in pF, or μF).

After completing each circuit board, check to make sure that all connections are soldered and that there are no solder bridges between adjacent foils. If you find a solder bridge, refer to the "Kit Builders Guide" for information on correcting it.



The steps performed in this Pictorial are in this area of the circuit board.

START

Position the preamplifier circuit board component side up as shown. You will work with the left side of the circuit board as shown in the identification drawing.

( ) 18 kΩ, 5% (brown-gray-orange-gold).

( ) 2700 Ω (red-violet-red).

( ) 12 kΩ, 5% (brown-red-orange-gold).

( ) 1.5 MΩ, 5% (brown-green-green-gold).

( ) 82 kΩ (gray-red-orange).

( ) 6800 Ω (blue-gray-red).

SAFETY WARNING: Avoid eye injury when you clip off excess leads. We suggest that you wear glasses, or at least clip the leads so the ends will not fly toward your eyes.

( ) Solder all leads to the foil and cut off the excess lead lengths.

( ) 10 kΩ (brown-black-orange).

( ) 15 kΩ (brown-green-orange).

( ) 270 kΩ (red-violet-yellow).

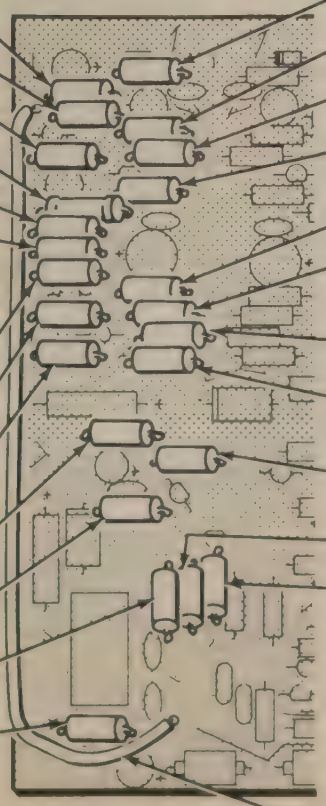
( ) 22 kΩ (red-red-orange).

( ) 2200 Ω (red-red-red).

( ) 270 Ω (red-violet-brown).

( ) 330 Ω (orange-orange-brown).

( ) Solder all leads to the foil and cut off the excess lead lengths.



PICTORIAL 1-1

CONTINUE

FOR GOOD SOLDERED CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN... WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH.

( ) 100 kΩ, 5% (brown-black-yellow-gold).

( ) 1500 Ω, 5% (brown-green-red-gold).

( ) 100 Ω, 5% (brown-black-brown-gold).

( ) 120 kΩ, 5% (brown-red-yellow-gold).

( ) 5600 Ω (green-blue-red).

( ) 270 kΩ (red-violet-yellow).

( ) Solder all leads to the foil and cut off the excess lead lengths.

( ) 68 kΩ (blue-gray-orange).

( ) 100 Ω, 5% (brown-black-brown-gold).

( ) 120 kΩ, 5% (brown-red-yellow-gold).

( ) 8200 Ω (gray-red-red).

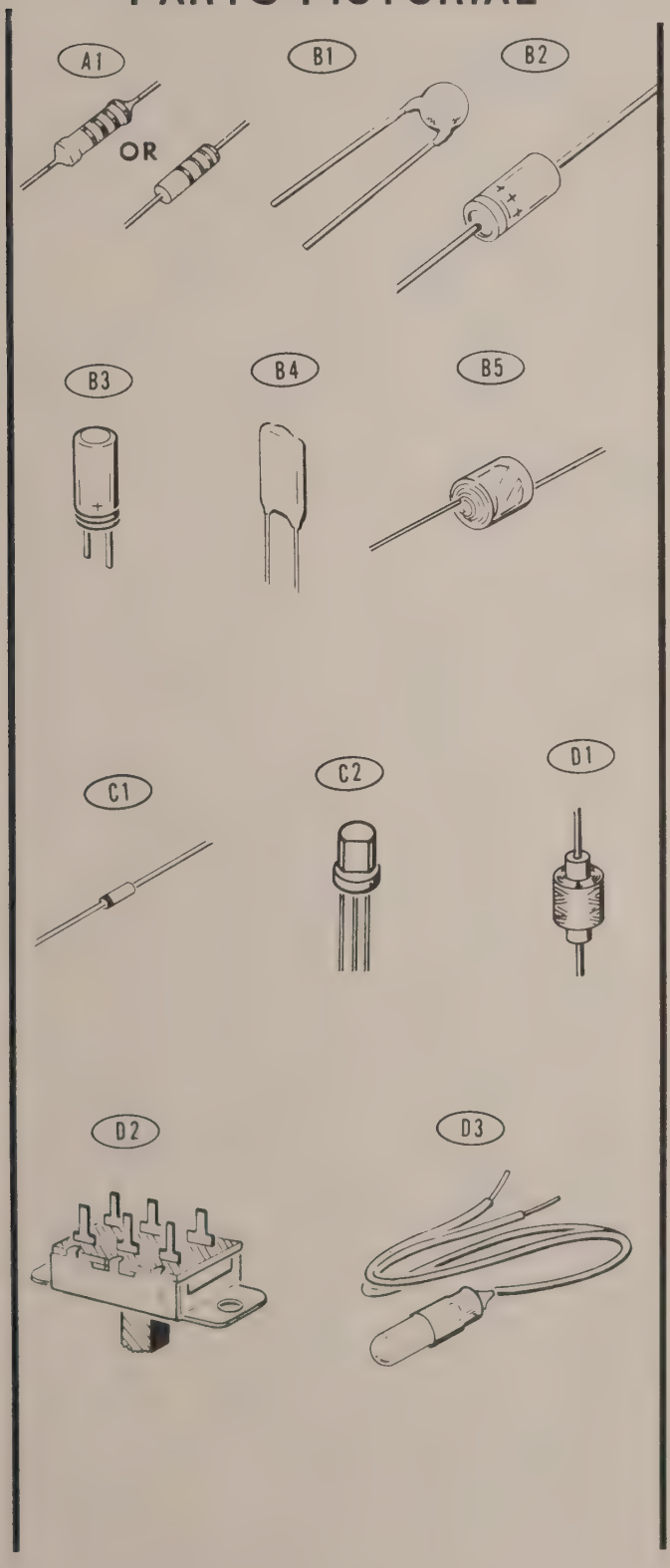
( ) 10 Ω (brown-black-black).

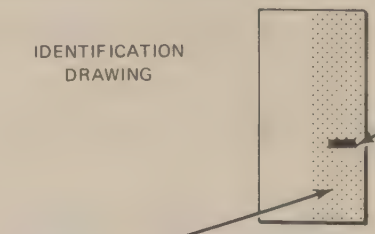
( ) Solder all leads to the foil and cut off the excess lead lengths.

NOTE: When you install a jumper wire, cut the red hookup wire to the specified length and remove 1/4" of insulation from both ends. Install the wire over the line on the circuit board and solder both ends in the indicated holes.

( ) 6-1/4" jumper.

PREAMPLIFIER CIRCUIT BOARD PARTS PICTORIAL





The steps performed in this Pictorial are in this area of the circuit board.

START

Refer to the identification drawing for the area of assembly.

( ) 100 kΩ, 5% (brown-black-yellow-gold).

( ) 1500 Ω, 5% (brown-green-red-gold).

( ) 100 Ω, 5% (brown-black-brown-gold).

( ) 120 kΩ, 5% (brown-red-yellow-gold).

( ) 5600 Ω (green-blue-red).

( ) 270 kΩ (red-violet-yellow).

FOR GOOD SOLDERED CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH

( ) Solder all leads to the foil and cut off the excess lead lengths.

( ) 68 kΩ (blue-gray-orange).

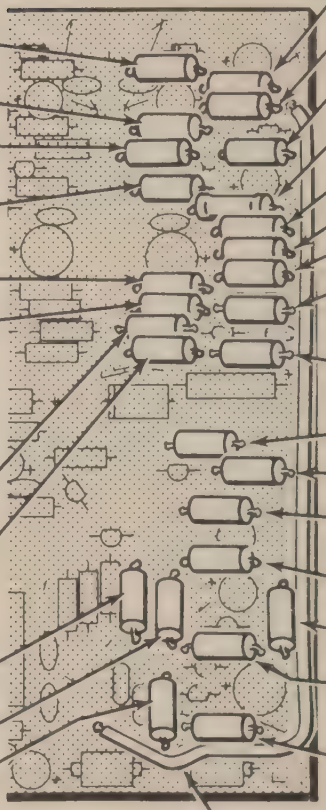
( ) 100 Ω, 5% (brown-black-brown-gold).

( ) 27 Ω (red-violet-black).

( ) 47 kΩ (yellow-violet-orange).

( ) 47 Ω (yellow-violet-black).

( ) Solder all leads to the foil and cut off the excess lead lengths.



CONTINUE

( ) 18 kΩ, 5% (brown-gray-orange-gold).

( ) 2700 Ω (red-violet-red).

( ) 12 kΩ, 5% (brown-red-orange-gold).

( ) 1.5 MΩ, 5% (brown-green-green-gold).

( ) 82 kΩ (gray-red-orange).

( ) 6800 Ω (blue-gray-red).

( ) 10 kΩ (brown-black-orange).

( ) 15 kΩ (brown-green-orange).

( ) Solder all leads to the foil and cut off the excess lead lengths.

( ) 270 kΩ (red-violet-yellow).

( ) 12 kΩ, 5% (brown-red-orange-gold).

( ) 1800 Ω (brown-gray-red).

( ) 100 kΩ, 5% (brown-black-yellow-gold).

( ) 4700 Ω (yellow-violet-red).

( ) 10 kΩ (brown-black-orange).

( ) 15 Ω (brown-green-black).

( ) Resistor - capacitor combination. Prepare as shown with a 2200 Ω resistor (red-red-red) and a .1 μF disc capacitor. After soldering, clip off the excess capacitor leads.

( ) Solder all leads to the foil and cut off the excess lead lengths.

( ) 6-1/2" jumper.

PICTORIAL 1-2

START

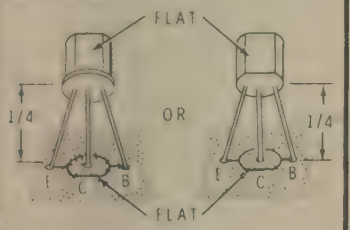
NOTE: Diodes may be supplied in any of the following shapes. Be sure to position the banded end of each diode as shown on the circuit board.

( ) 1N4149 diode (#56-56) at D1.

( ) 1N4149 diode (#56-56) at D2.

( ) Solder all leads to the foil and cut off the excess lead lengths.

NOTE: Install the transistors in the following manner, as shown: First, match the flat side of the transistor with the outline of the flat on the circuit board. Then insert the transistor leads into their correct holes, which are indicated by the letters E, C, and B. Position the transistors 1/4" away from the circuit board. Then solder each lead to its foil and cut off the excess lead lengths.



( ) 2N3393 transistor (#417-118) at Q7.

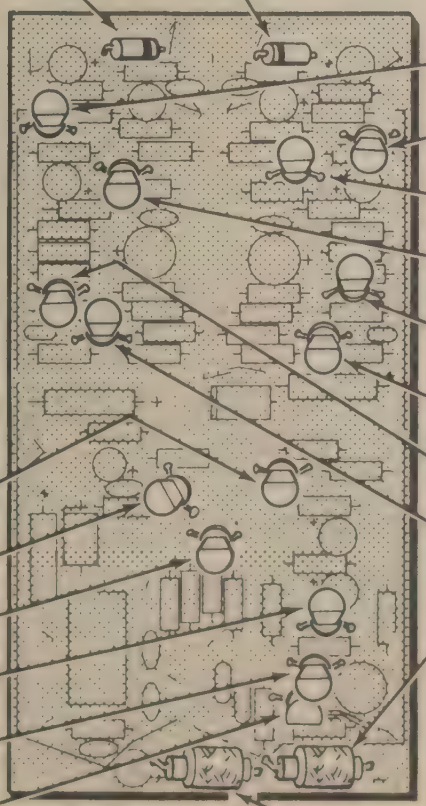
( ) 2N3393 transistor (#417-118) at Q6.

( ) 2N3416 transistor (#417-94) at Q5.

( ) X29A829 transistor (#417-201) at Q9.

( ) 2N3393 transistor (#417-118) at Q8.

( ) 2N3416 transistor (#417-94) at Q10.



PICTORIAL 1-3

CONTINUE

( ) X29A829 transistor (#417-201) at Q4L.

( ) X29A829 transistor (#417-201) at Q4R.

( ) 2N5232A transistor (#417-91) at Q3R.

( ) 2N5232A transistor (#417-91) at Q3L.

( ) 2N5232A transistor (#417-91) at Q2R.

( ) TZ1160 transistor (#417-218) at Q1R.

( ) 2N5232A transistor (#417-91) at Q2L.

( ) TZ1160 transistor (#417-218) at Q1L.

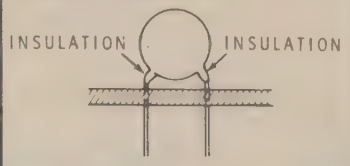
( ) 2 mH choke (#45-47). Bend the leads towards the slot.

( ) 2 mH choke (#45-47). Make sure this choke does not touch the one just installed.

( ) Be sure all connections are soldered and that the excess lead lengths are cut off.

START

NOTE: When you install disc capacitors, do not push the insulated portion of the leads into the circuit board holes. This could make it difficult to solder the leads to the foil. Also the leads of the Mylar capacitors may be coated with a clear film. If any soldering problem is encountered with these capacitors, apply more heat to the leads to melt this film.



( ) .002 µF disc.

( ) .002 µF disc.

( ) .1 µF disc.

( ) .1 µF disc.

( ) .01 µF Mylar.

( ) .01 µF Mylar.

( ) Solder all leads to the foil and cut off the excess lead lengths.

NOTE: Since the values of the following capacitors appear very similar, check them carefully before you install them.

( ) .002 µF disc.

( ) .022 µF Mylar.

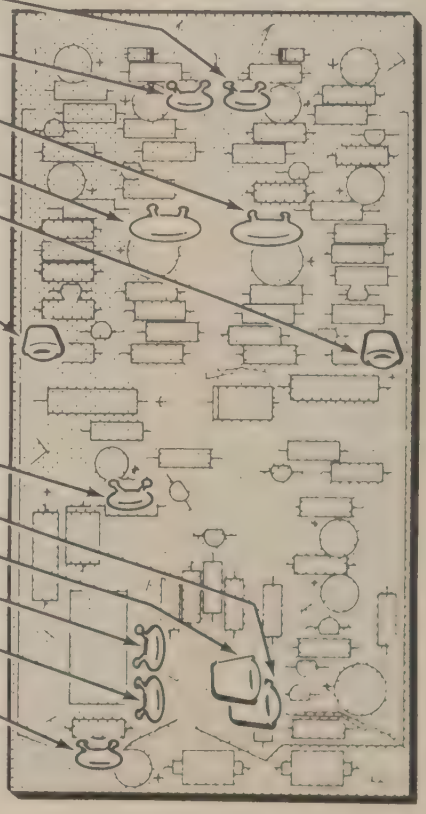
( ) .022 µF Mylar.

( ) .002 µF disc.

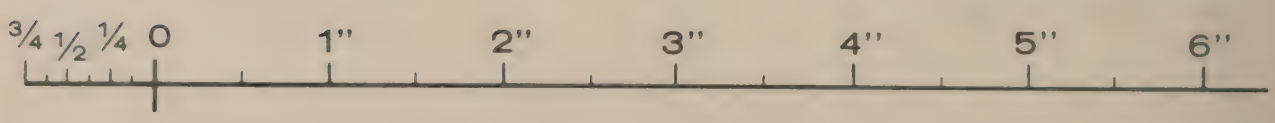
( ) 220 pF disc.

( ) .001 µF disc.

( ) Solder all leads to the foil and cut off the excess lead lengths.

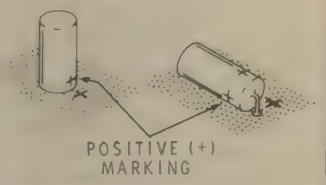


PICTORIAL 1-4



START

When you install electrolytic capacitors, always match the positive (+) mark on the capacitor with the positive (+) mark on the circuit board.



( ) 10 μF electrolytic.

( ) 10 μF electrolytic.

( ) 10 μF electrolytic.

( ) 50 μF electrolytic.

( ) 2 μF electrolytic.

( ) Solder all leads to the foil and cut off the excess lead lengths.

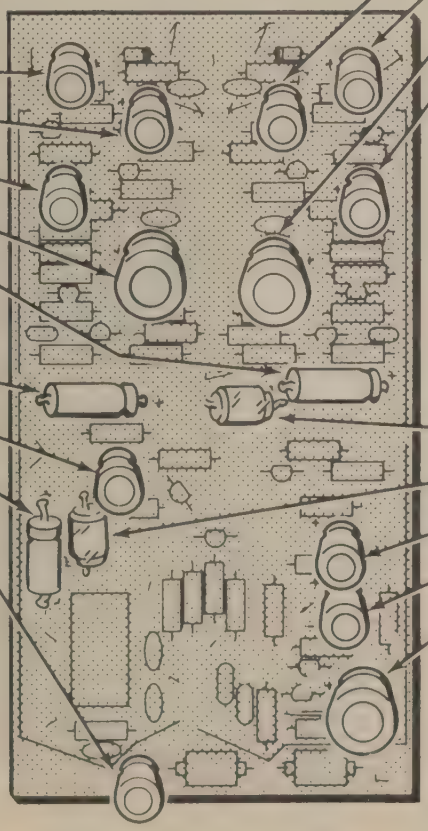
( ) 2 μF electrolytic.

( ) 10 μF electrolytic.

( ) 2 μF electrolytic.

( ) 10 μF electrolytic.

( ) Solder all leads to the foil and cut off the excess lead lengths.



CONTINUE

( ) 10 μF electrolytic.

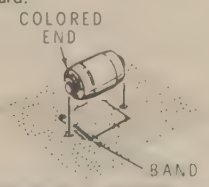
( ) 10 μF electrolytic.

( ) 50 μF electrolytic.

( ) 10 μF electrolytic.

( ) Solder all leads to the foil and cut off the excess lead lengths.

When you install polystyrene capacitors, align the colored end with the band on the circuit board.



( ) 1800 pF polystyrene.

( ) 1800 pF polystyrene.

( ) 10 μF electrolytic.

( ) 10 μF electrolytic.

( ) 100 μF electrolytic.

( ) Solder all leads to the foil and cut off the excess lead lengths.

PICTORIAL 1-5

START

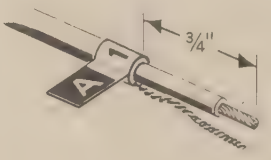
( ) Refer to Detail 1-6A (fold-out from Page 10) and prepare both ends of eight gray shielded cables. The lengths are called out in the Detail. Then return to this Pictorial to install them.

NOTE: As you install each of the following cables, solder the leads to the foil. Then install the proper label as shown.

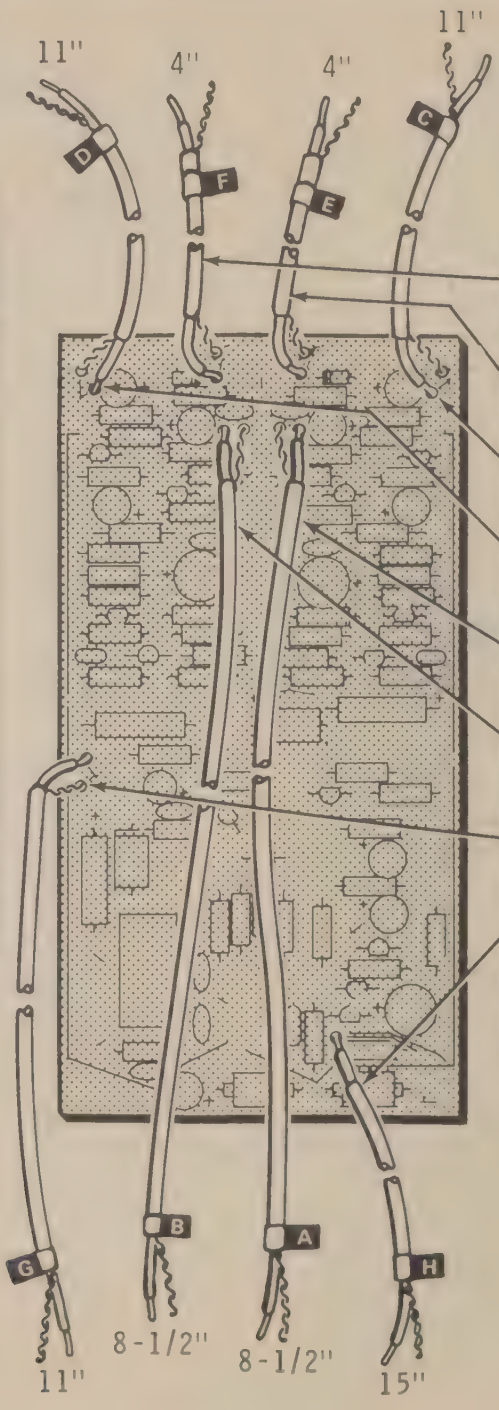
A. Peel the label from the paper and cut the label in half.

DISCARD

B. Place the half with the letter around the cable about 3/4" from the free end.



C. In order to make the label stick together properly, pull the end between your finger nails several times.



CONTINUE

( ) 4" cable with the inner lead at LT AUD OUT, and the shield lead at S. Label the cable F.

( ) 4" cable with the inner lead at RT AUD OUT, and the shield lead at S. Label the cable E.

( ) 11" cable with the inner lead at VOL RT, and the shield lead at S. Label the cable C.

( ) 11" cable with the inner lead at VOL LT, and the shield lead at S. Label the cable D.

( ) 8-1/2" cable with the inner lead at BAL RT, and the shield lead at S. Label the cable A.

( ) 8-1/2" cable with the inner lead at BAL LT, and the shield lead at S. Label the cable B.

( ) 11" cable with the inner lead at MIC LEVEL, and the shield at S. Label the cable G.

( ) 15" cable with the inner lead at ORG. Cut off the shield lead at this end of the cable only. Label the cable H.

NOTE: Save the remaining portion of the letter label. It will be used later.

PICTORIAL 1-6

START

( ) Remove 1/4" of insulation from both ends of a 4" length of black wire. Solder one end of the wire into the hole lettered BLK. The other end will be connected later.

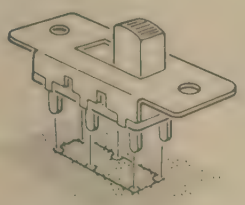
( ) Locate the two lamps. Twist together the bare ends of one lead from each lamp. Insert these leads into the hole marked PWR & REC IND and solder the leads to the foil.

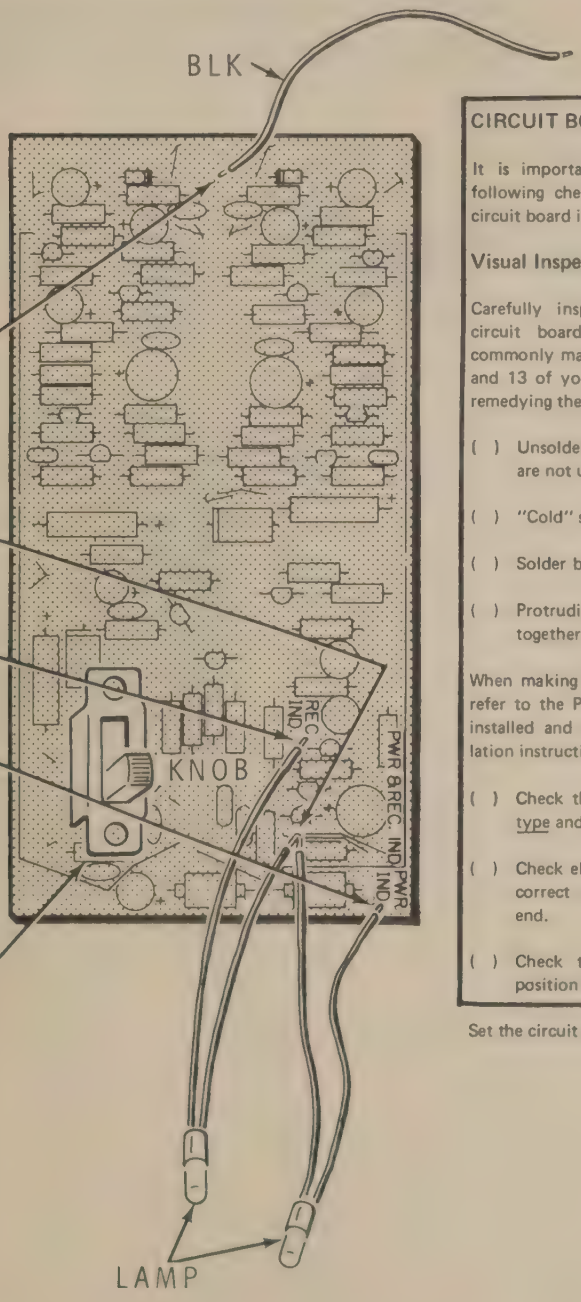
( ) Solder the free lead from either lamp into the hole marked REC IND.

( ) Solder the free lead from the other lamp into the hole marked PWR IND.

CAUTION: The switch that you will install in the next step has a spring return operation. Therefore, be sure and position the knob as shown. Otherwise, the kit will not operate properly.

( ) Slide switch. Solder all six pins to the foil.





CIRCUIT BOARD CHECKOUT

It is important that you complete the following checkout procedure after each circuit board is completed.

Visual Inspection

Carefully inspect the foil side of the circuit board for the following most commonly made errors. Refer to Pages 12 and 13 of your "Kit Builders Guide" for remedying these problems, if any exist.

( ) Unsoldered connections (eight holes are not used at this time).

( ) "Cold" solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads which could touch together.

When making the following visual checks, refer to the Pictorial where the part was installed and check it against the installation instructions.

( ) Check the transistor for the proper type and installation.

( ) Check electrolytic capacitors for the correct position of the positive (+) end.

( ) Check the diodes for the correct position of the banded end.

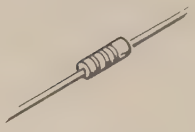
Set the circuit board aside temporarily.

PICTORIAL 1-7

MOTOR CONTROL CIRCUIT BOARD PARTS PICTORIAL

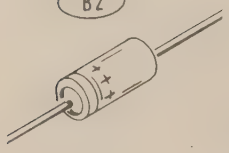
A1

A2

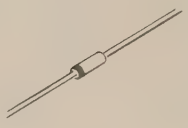


B1

B2



C1



C2

C3

D1

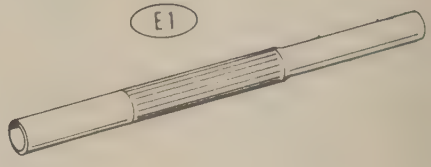
D2

D3

D4

D5

E1



MOTOR CONTROL CIRCUIT BOARD

PARTS LIST

Unpack the package marked #2 and check each part against the following list. The key numbers correspond to the numbers on the Motor Control Circuit Board Parts Pictorial.

Any part that is packaged in an individual envelope with a part number on it should be placed back in its envelope after it is identified until it is called for in a step.

RESISTORS

NOTE: All resistors are 1/2-watt, 10% unless otherwise specified.

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
A1	1-134	1	3.9 Ω, 5% (orange-white-gold-gold)	.10
A1	1-54	1	15 Ω, 5% (brown-green-black-gold)	.10
A1	1-56	1	240 Ω, 5% (red-yellow-brown-gold)	.10
A1	1-7	2	680 Ω (blue-gray-brown)	.10
A1	1-81	1	1500 Ω, 5% (brown-green-red-gold)	.10
A1	1-89	1	2400 Ω, 5% (red-yellow-red-gold)	.10
A1	1-13	1	2700 Ω (red-violet-red)	.10
A1	1-16	1	4700 Ω (yellow-violet-red)	.10
A1	1-51	1	6800 Ω, 5% (blue-gray-red-gold)	.10
A1	1-114	1	8200 Ω, 5% (gray-red-red-gold)	.20
A1	1-26	1	100 kΩ (brown-black-yellow)	.10
A2	1-43-12	1	120 Ω, 1/4-watt, 10% (brown-red-brown)	.10

CAPACITORS

B1	21-140	3	.001 μF disc	.10
B2	25-54	2	10 μF electrolytic	.20

DIODES-TRANSISTORS

C1	56-56	3	1N4149 silicon diode	.20

NOTE: Transistors are marked for identification in one of the following four ways.

1. Part number.
2. Type number.
3. Part number and type number.
4. Part number with a type number other than the one listed.

C2	417-118	2	2N3393 transistor	.40
C2	417-201	1	X29A829 transistor	.50
C3	417-225	1	MPSU55 transistor	1.30

MISCELLANEOUS

D1	10-295	1	750 Ω control	.45
D2	204-1294	2	Circuit board mounting bracket	.35
D3	250-52	2	4-40 x 1/4" screw	.05
D4	252-15	2	4-40 nut	.05
D5	254-9	2	#4 lockwasher	.05
	344-53	1	Orange wire	.05/ft

PARTS FROM PACK #3

	85-1115-2	1	Motor control circuit board	.85
E1	490-5	1	Plastic nut starter	.10

NOTE: See Page 59 for "Replacement Parts and Price Information."

STEP-BY-STEP ASSEMBLY

START

Position the circuit board as shown for the following steps.

( ) 120 Ω, 1/4-watt (brown-red-brown).

( ) 240 Ω, 5% (red-yellow-brown-gold).

( ) 15 Ω, 5% (brown-green-black-gold).

( ) 3.9 Ω, 5% (orange-white-gold-gold).

( ) 2400 Ω, 5% (red-yellow-red-gold).

( ) 6800 Ω, 5% (blue-gray-red-gold).

FOR GOOD SOLDERED CONNECTIONS, YOU MUST KEEP THE SOLDERING IRON TIP CLEAN

WIPE IT OFTEN WITH A DAMP SPONGE OR CLOTH

( ) Solder all leads to the foil and cut off the excess lead lengths.

( ) 1500 Ω, 5% (brown-green-red-gold).

( ) 8200 Ω, 5% (gray-red-red-gold).

( ) 680 Ω (blue-gray-brown).

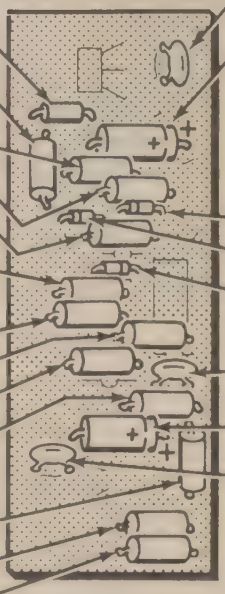
( ) 4700 Ω (yellow-violet-red).

( ) 100 kΩ (brown-black-yellow).

( ) 2700 Ω (red-violet-red).

( ) 680 Ω (blue-gray-brown).

( ) Solder all leads to the foil and cut off the excess lead lengths.

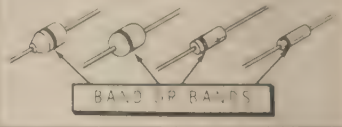


CONTINUE

( ) .001 µF disc.

( ) 10 µF electrolytic. Position the positive (+) end as shown.

NOTE: DIODES MAY BE SUPPLIED IN ANY OF THE FOLLOWING SHAPES. THE CATHODE END OF THE DIODE IS MARKED WITH A BAND OR BANDS. ALWAYS POSITION THIS END AS SHOWN IN THE PICTORIAL.



( ) 1N4149 diode (#56-56) at D4.

( ) 1N4149 diode (#56-56) at D5.

( ) 1N4149 diode (#56-56) at D3.

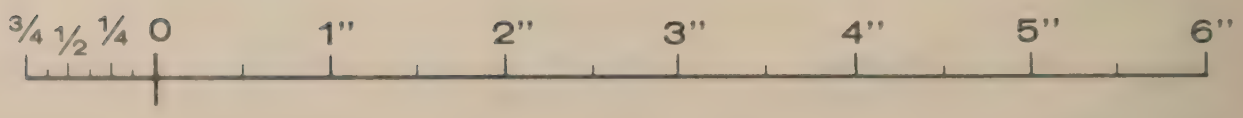
( ) .001 µF disc.

( ) 10 µF electrolytic. Position the positive (+) end as shown.

( ) .001 µF disc.

( ) Solder all leads to the foil and cut off the excess lead lengths.

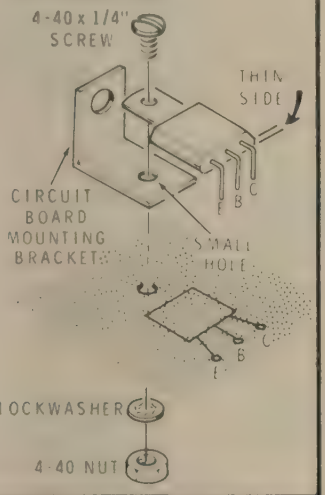
PICTORIAL 2-1



START

NOTE: Use the plastic nut starter supplied with this kit to hold and start 6-32 and 4-40 nuts on screws. Refer to Page 3 of the Kit Builders Guide.

( ) Position the MPSU55 transistor (#417-225) over its outline so the hole in the transistor is aligned with the hole in the circuit board. Be sure the thin side of the body of the transistor is closest to the circuit board. Then bend the transistor leads so they line up with their holes in the circuit board.



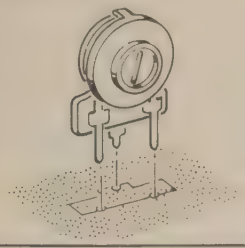
( ) Mount the circuit board mounting bracket and the transistor at Q14. Use a 4-40 x 1/4" screw, a #4 lockwasher, and a 4-40 nut. Then solder the E, B, and C leads of the transistor to the foil.

( ) Circuit board mounting bracket. Use a 4-40 x 1/4" screw, a #4 lockwasher, and a 4-40 nut through the small bracket-hole.

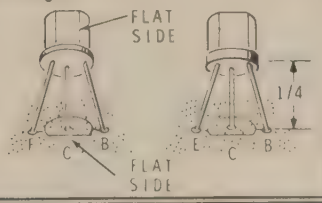
PICTORIAL 2-2

CONTINUE

( ) 750 Ω control (#10-295). Solder all three pins to the foil.



NOTE: Install the transistors in the following manner, as shown: First, match the flat side of the transistor with the outline of the flat on the circuit board. Then insert the transistor leads into their correct holes, which are indicated by the letters E, C, and B. Position the transistors 1/4" away from the circuit board. Then solder each lead to its foil and cut off the excess lead lengths.



( ) 2N3393 transistor (#417-118) at Q13.

( ) X29A829 transistor (#417-201) at Q12.

( ) 2N3393 transistor (#417-118) at Q11.

( ) Solder one end of a 4-1/2" orange wire into the hole marked ORG. The free end will be connected later.

CIRCUIT BOARD CHECKOUT

It is important that you complete the following checkout procedure after each circuit board is completed.

Visual Inspection

Carefully inspect the foil side of the circuit board for the following most commonly made errors. Refer to pages 12 and 13 of your "Kit Builders Guide" for remedying these problems, if any exist.

( ) Unsoldered connections (eight holes are not used at this time).

( ) "Cold" solder connections.

( ) Solder bridges between foil patterns.

( ) Protruding leads which could touch together.

When making the following visual checks, refer to the Pictorial where the part was installed and check it against the installation instructions.

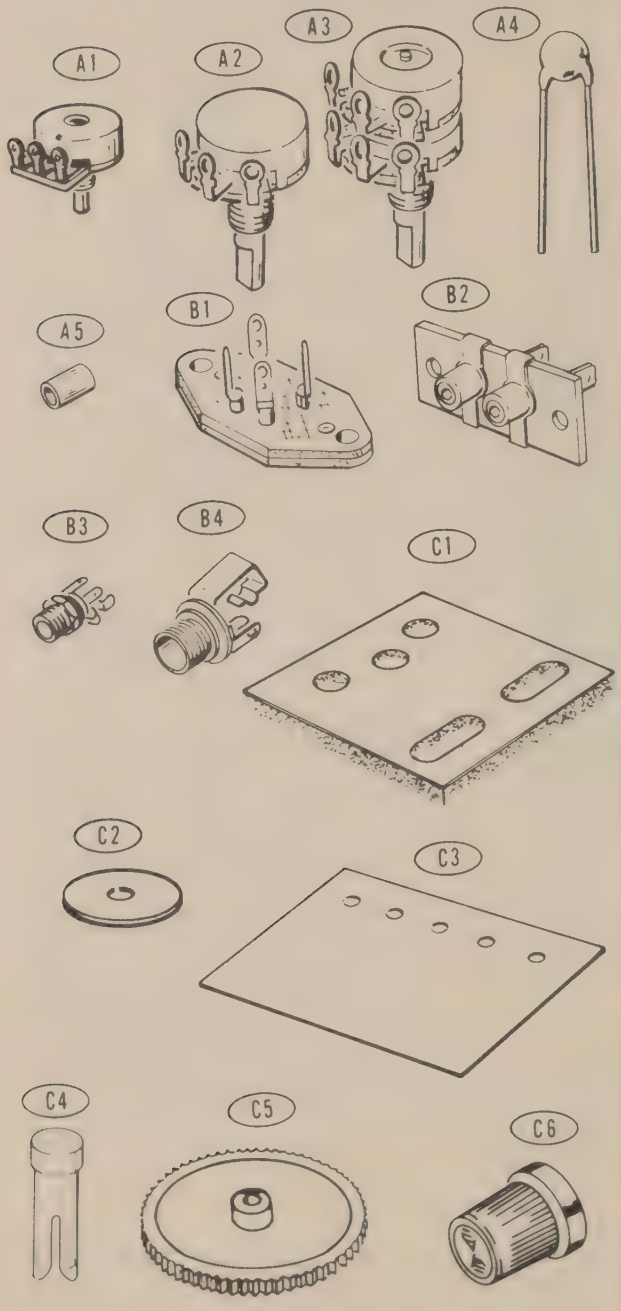
( ) Check the transistor for the proper type and installation.

( ) Check electrolytic capacitors for the correct position of the positive (+) end.

( ) Check the diodes for the correct position of the banded end.

Set the circuit board aside temporarily. **FINISH**

CHASSIS PARTS PICTORIAL



CHASSIS

PARTS LIST

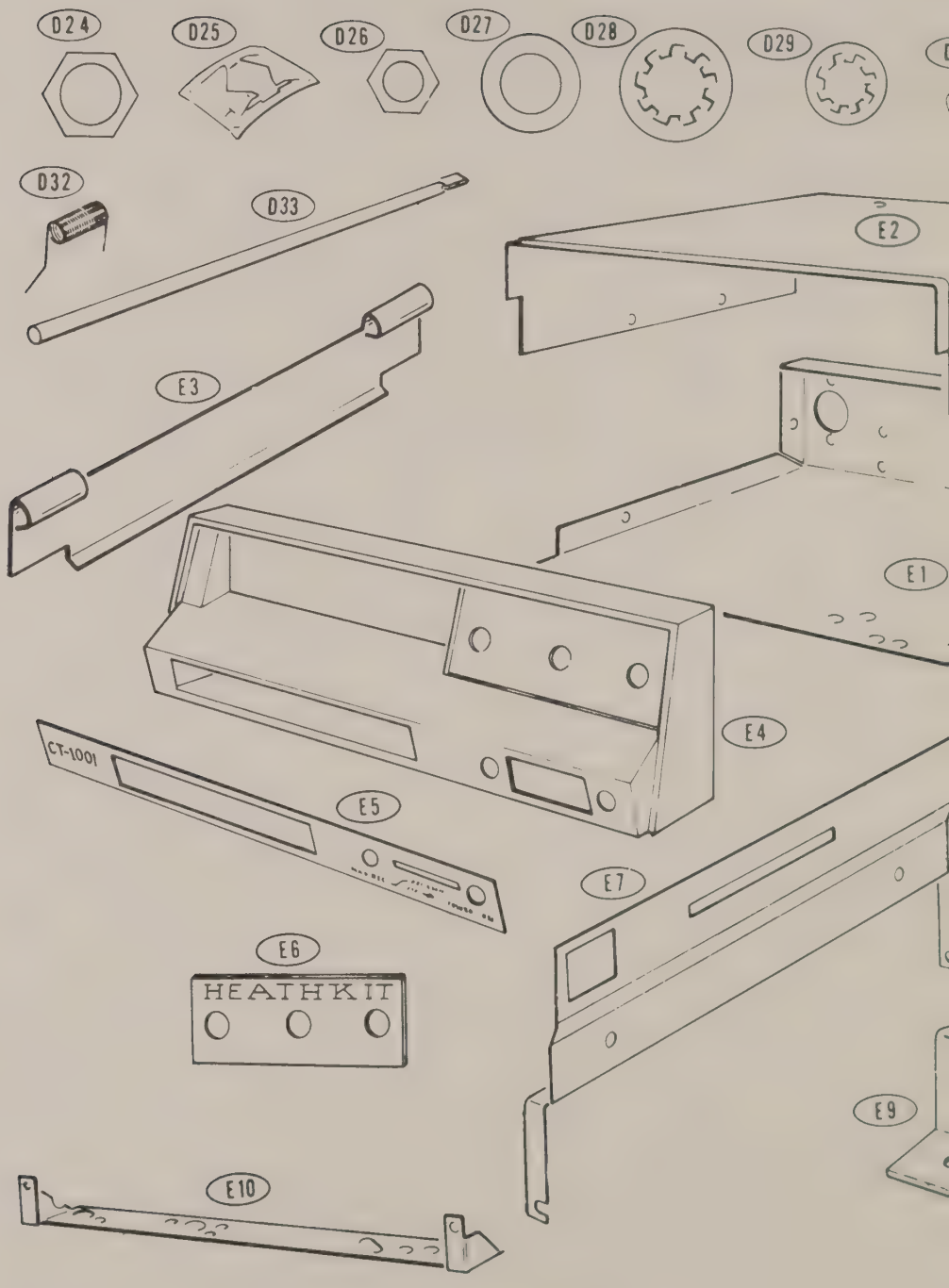
Unpack package #3, which is all the remaining parts, and check each part against the following list. The key numbers correspond to the numbers on the Chassis Parts Pictorial (fold-out from Page 22). Any part that is packaged in an individual envelope or carton with a part number on it should be placed back in its envelope or carton after it is identified until it is called for in a step.

KEY No.	PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
CONTROLS-CAPACITORS-FERRITE BEADS				
A1	10-913	1	1000 Ω control	1.60
A2	10-944	1	20 kΩ control	.65
A3	12-127	2	10 kΩ, 10 kΩ tandem control	2.45
A4	21-140	3	.001 μF disc capacitor	.10
A4	21-95	2	.1 μF disc capacitor	.15
A5	475-10	8	Ferrite bead	.10
SOCKETS-JACKS				
B1	432-17	1	4-lug socket	.10
B2	434-174	1	Dual phono socket	.15
B3	436-28	1	Pause switch jack	.30
B4	436-16	1	Microphone jack	.55
GASKETS-INSULATOR-LENS-KNOBS				
C1	73-120	2	Gimbal bracket gaset	.10
C2	75-187	1	Plastic insulator	.10
C3	75-156	2	Insulating paper	.10
C4	413-10	1	Red lens	.10
C4	413-32	1	Blue lens	.10
C5	462-395	1	Black thumb knob	.35
C6	462-291	3	Control knob	.50
WIRE-CABLE TIE				
	344-50	1	Black wire	.05/ft
	344-52	1	Red wire	.05/ft
	344-54	1	Yellow wire	.05/ft
	344-56	1	Blue wire	.05/ft
	354-6	2	Cable tie	.10

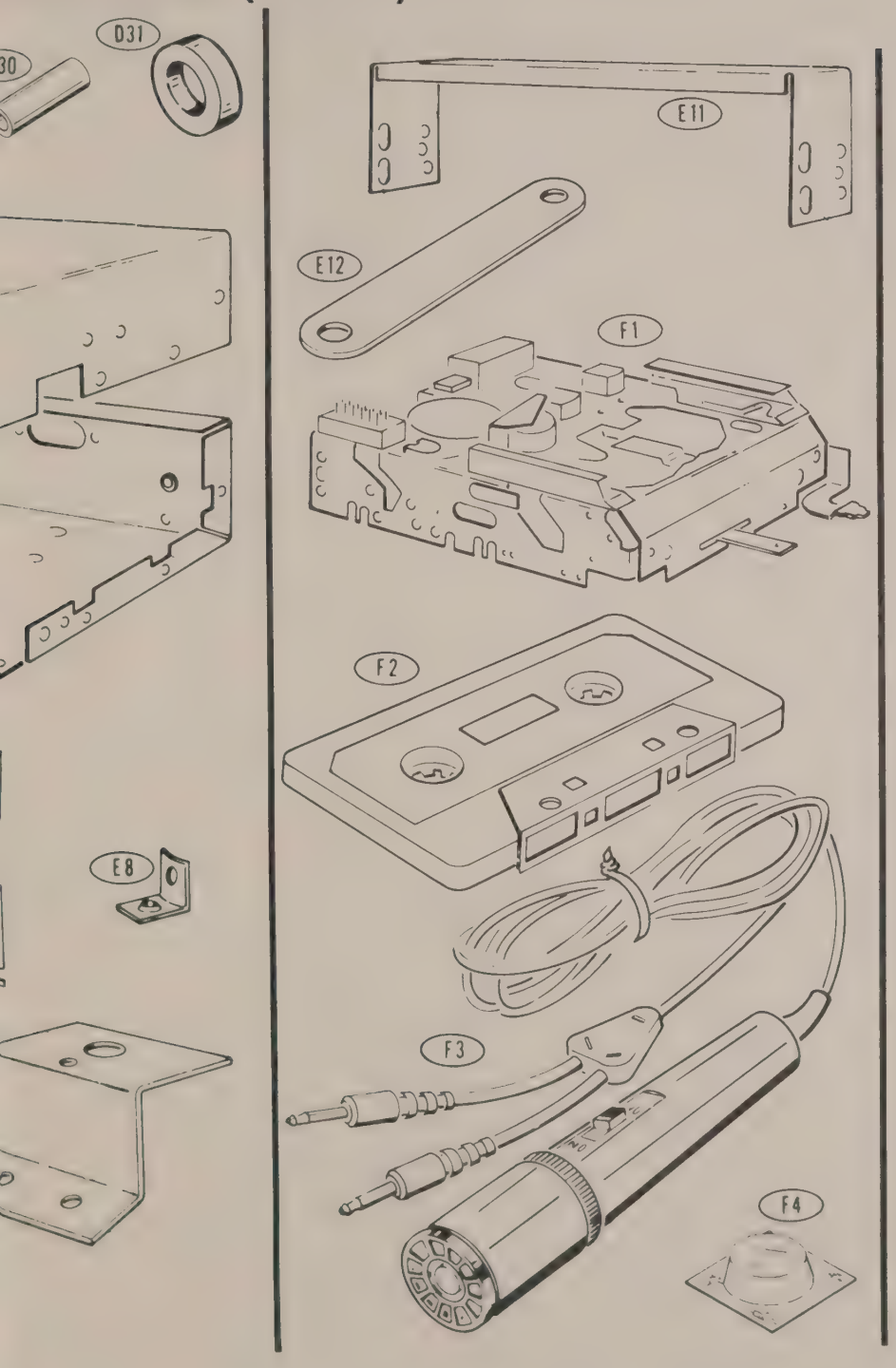
KEY No.	PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
HARDWARE				
#4 Hardware				
D1	250-52	4	4-40 x 1/4" screw	.05
D2	250-1106	2	4-40 x 5/16" black flat head screw	.05
D3	250-1153	8	4-40 x 5/16" black phillips head screw	.05
D4	250-273	2	4-40 x 3/8" screw	.05
D5	250-1107	3	4-40 x 15/16" black flat head screw	.05
D6	252-15	10	4-40 nut	.05
D7	252-50	8	#4 Speed Nut*	.05
D8	254-9	10	#4 lockwasher	.05
D9	254-41	6	#4 split lockwasher	.05
#6 Hardware				
D10	250-56	2	6-32 x 1/4" screw	.05
D11	250-1109	4	6-32 x 1/4" flat head screw	.05
D12	250-276	4	6-32 x 3/8" flat head screw	.05
D13	252-3	6	6-32 nut	.05
D14	253-2	1	#6 fiber shoulder washer	.05
D15	254-1	5	#6 lockwasher	.05
D16	259-1	1	#6 shakeproof solder lug	.05
D17	259-6	1	#6 solder lug	.05
#10 Hardware				
D18	250-1161	7	10-32 x 3/8" allen head screw	.05
D19	252-5	3	10-32 nut	.05
D20	253-3	4	#10 fiber washer	.05
D21	253-98	9	#10 flat washer	.05
D22	254-3	1	#10 lockwasher	.05
D23	254-38	3	#10 split lock-washer	.05

*Registered Trademark, Tinnerman Company

CHASSIS PARTS



PICTORIAL (Cont'd.)



KEY No.	PART No.	PARTS Per Kit	DESCRIPTION	PRICE Each
Hardware (cont'd.)				
Other Hardware				
D24	252-7	3	Control nut	.05
D25	252-9	2	Push-on nut	.05
D26	252-39	2	Microphone control nut	.05
D27	253-10	3	Control flat washer	.05
D28	254-4	6	Control lockwasher	.05
D29	254-14	1	Microphone jack lockwasher	.05
D30	255-15	3	1/2" spacer	.05
D31	255-30	3	Control spacer	.10
D32	258-162	1	Door spring	.10
D33	262-40	1	Hinge pin	.15
METAL PARTS				
E1	90-548-1	1	Chassis	1.70
E2	100-1080	1	Cabinet top	1.60
E3	203-873	1	Flip door	.75
E4	203-1461	1	Front panel	2.40
E5	203-875	1	Trim strip	.30
Metal Parts (cont'd.)				
E6	203-1462	1	Trim panel	.20
E7	203-876-1	1	Door mounting panel	1.20
E8	204-9	4	Transport mounting bracket	.10
E9	204-1296	1	Level control mounting bracket	.45
E10	204-1298	1	Front panel support bracket	.70
E11	204-1299-1	1	Gimbal mounting bracket	1.05
E12	205-864-1	2	Interconnector bracket	.20
MISCELLANEOUS				
F1	416-10	1	Tape transport (includes knobs and metric screws)	47.30
F2	448-240	1	Test tape	3.20
F3	480-65	1	Dictation microphone	5.00
F4	352-13	1	Silicone grease pod	.15
	391-34	1	Blue and white label	
	597-308	1	Kit Builders Guide	
	597-260	1	Parts Order Form	
			Solder (Additional 3' rolls of solder, #331-6, can be ordered for 15 cents each.)	

NOTE: See Page 59 for "Replacement Parts and Price Information."

STEP-BY-STEP ASSEMBLY

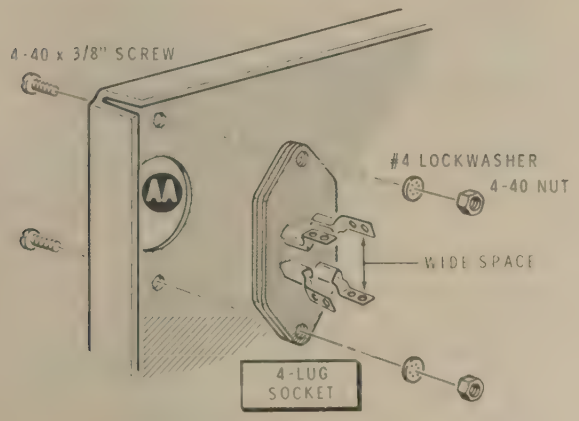
CHASSIS PARTS MOUNTING

Refer to Pictorial 3-1 (fold-out from Page 25) for the following steps.

( ) Place a soft cloth on your work surface so that the painted parts will not become scratched.

( ) Locate the chassis and place it on the cloth in front of you as shown.

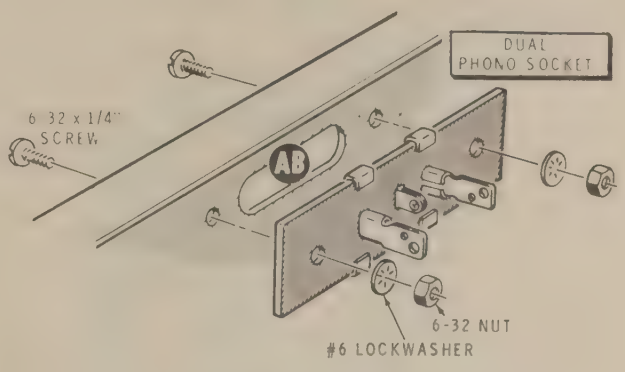
NOTE: When hardware is called for, as in the next step, only the screw size will be given. For example, if "4-40 x 3/8" hardware" is called for, it means that a 4-40 x 3/8" screw, one or more #4 lockwashers, and a 4-40 nut should be used for each mounting hole. The Detail referred to in each step will show the proper number of lockwashers to use.



Detail 3-1A

( ) Refer to Detail 3-1A and mount a 4-lug socket at AA as shown. Use 4-40 x 3/8" hardware and be sure to position the connector so the wide spaced lugs are as shown.

( ) Refer to Detail 3-1B and mount a dual phono socket at AB as shown. Use 6-32 x 1/4" hardware.

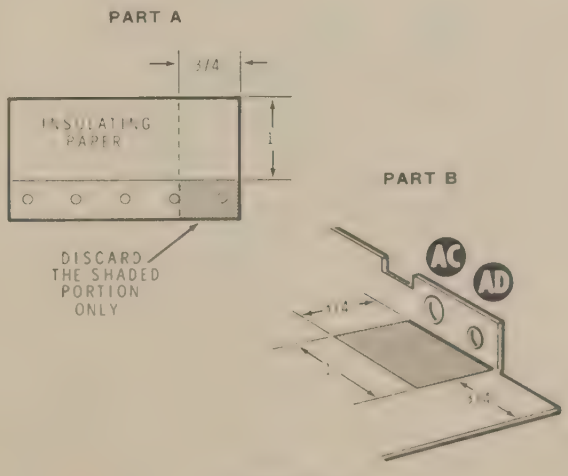


Detail 3-1B

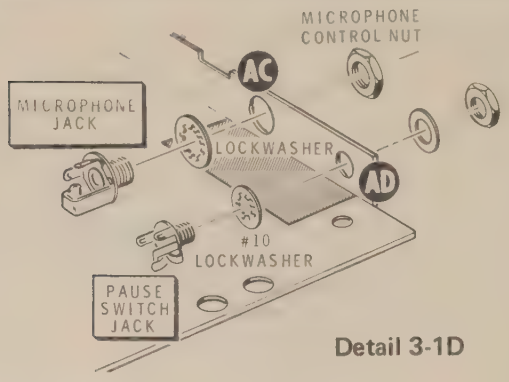
Refer to Detail 3-1C for the following steps.

( ) Locate the insulating paper. Then refer to Part A of Detail 3-1C and cut off a 3/4" x 1" piece as shown. Save the remaining portion of the insulating paper.

( ) Refer to Part B of the Detail and remove the backing paper and stick this small piece of insulator on the chassis below holes AC and AD. Measure 3/4" from the front of the chassis.



Detail 3-1C

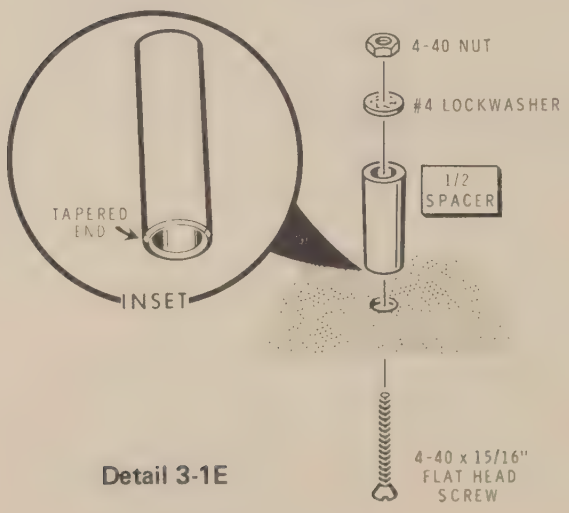


Detail 3-1D

Refer to Detail 3-1D for the next two steps.

( ) Mount a microphone jack at AC with a microphone jack lockwasher and a microphone control nut as shown.

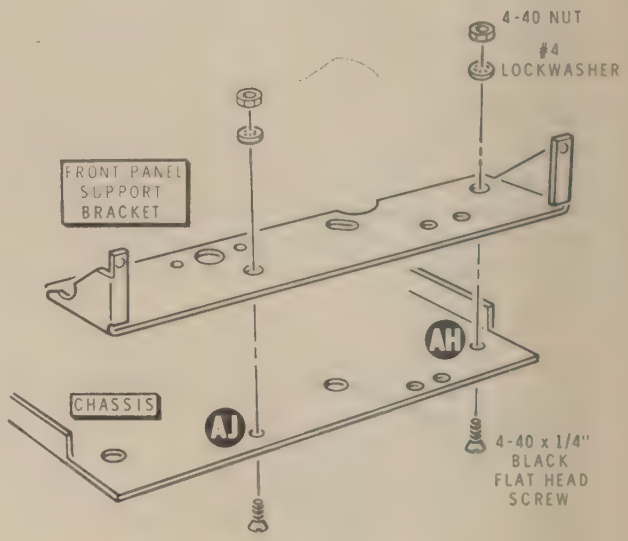
( ) Locate the pause switch jack and remove the nut and flat washer. Then mount the jack, as shown, at AD with a #10 lockwasher and the hardware just removed.



Detail 3-1E

( ) Refer to Detail 3-1E and mount 1/2" spacers at AE, AF, and AG with 4-40 x 15/16" hardware as shown. Make sure the countersunk end is against the chassis. See the inset drawing to identify the countersunk end.

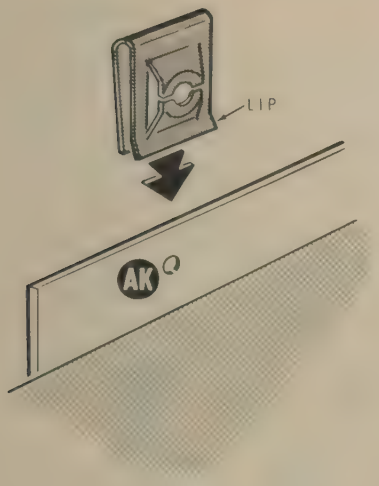
( ) Refer to Detail 3-1F and mount the front panel support bracket on the chassis as shown. Use 4-40 x 1/4" black flat head hardware at AJ and AH. Tighten the hardware just finger tight.



Detail 3-1F

( ) Refer to Detail 3-1G and install #4 Speed Nuts at the following locations. Make sure the lip is always positioned toward the inside of the chassis.

AK	AR
AL	AS
AN	AT
AP	AU



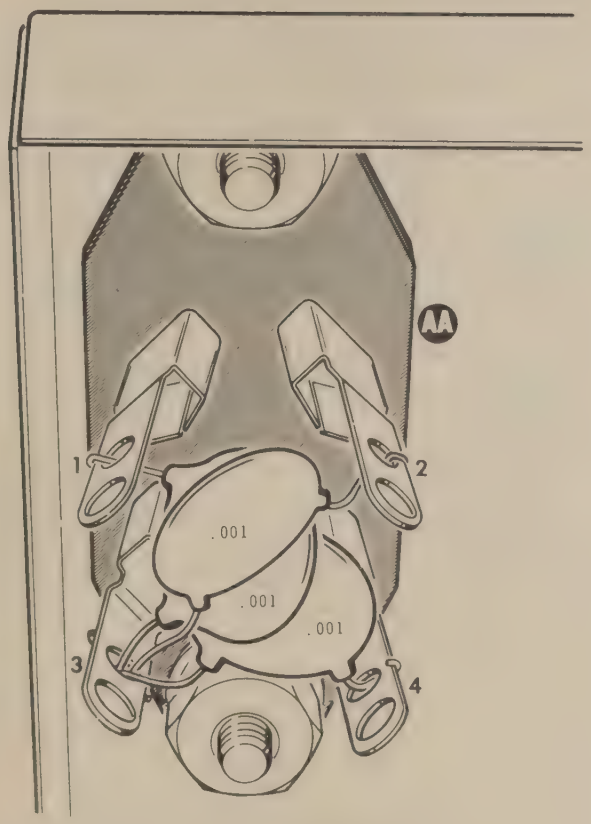
Detail 3-1G

( ) Locate three .001 μF disc capacitors and cut the leads of each capacitor to 3/8".

NOTE: When you make a solder connection in the following steps, be sure the solder does not flow into the large holes in the lugs.

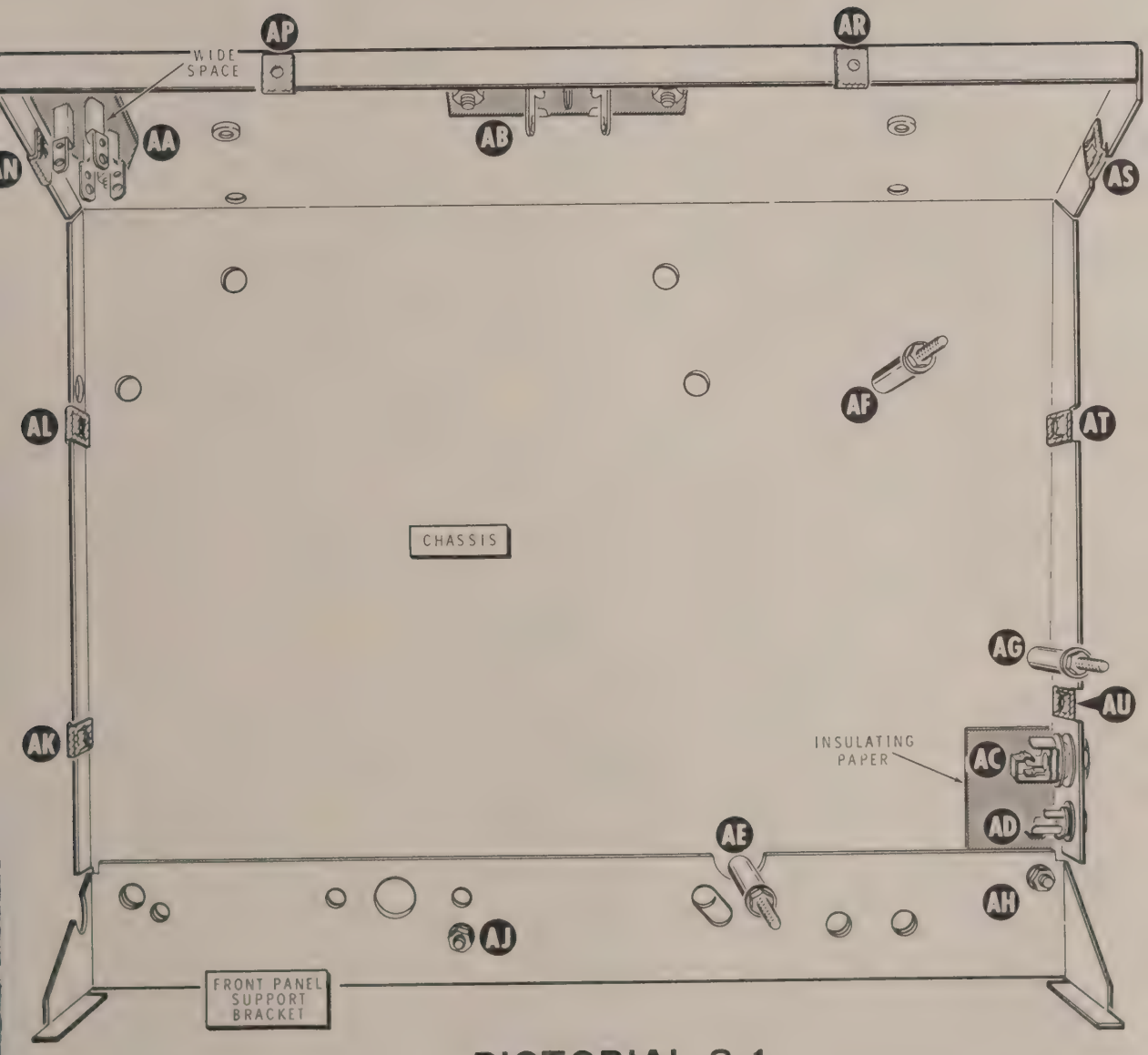
( ) Refer to Detail 3-1H and connect one of these .001 μF disc capacitors from the small hole in lug 4 (S-1) to the small hole in lug 3 (NS) of connector AA.

( ) Connect a .001 μF disc capacitor from the small hole in lug 2 (S-1) to the small hole in lug 3 of connector AA (NS).

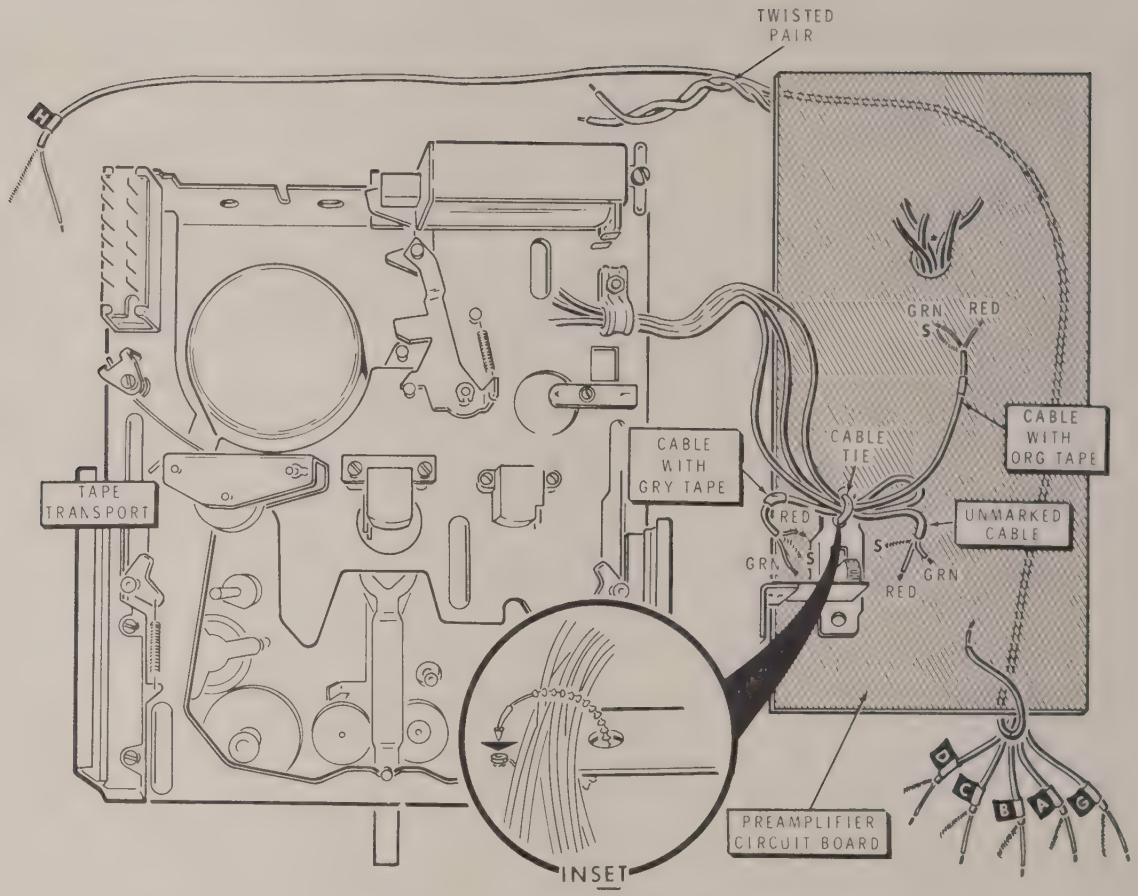


Detail 3-1H

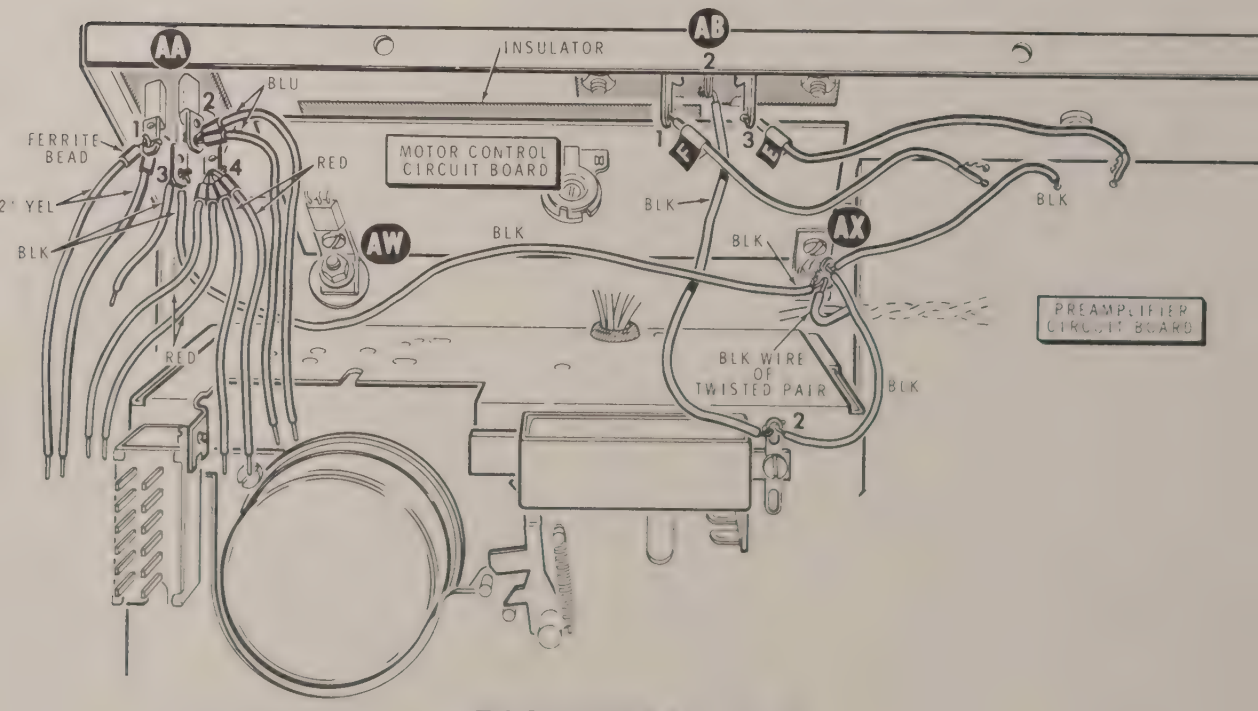
( ) Connect the remaining .001 μF disc capacitor from the small hole in lug 1 (S-1) to the small hole in lug 3 of connector AA (S-3).



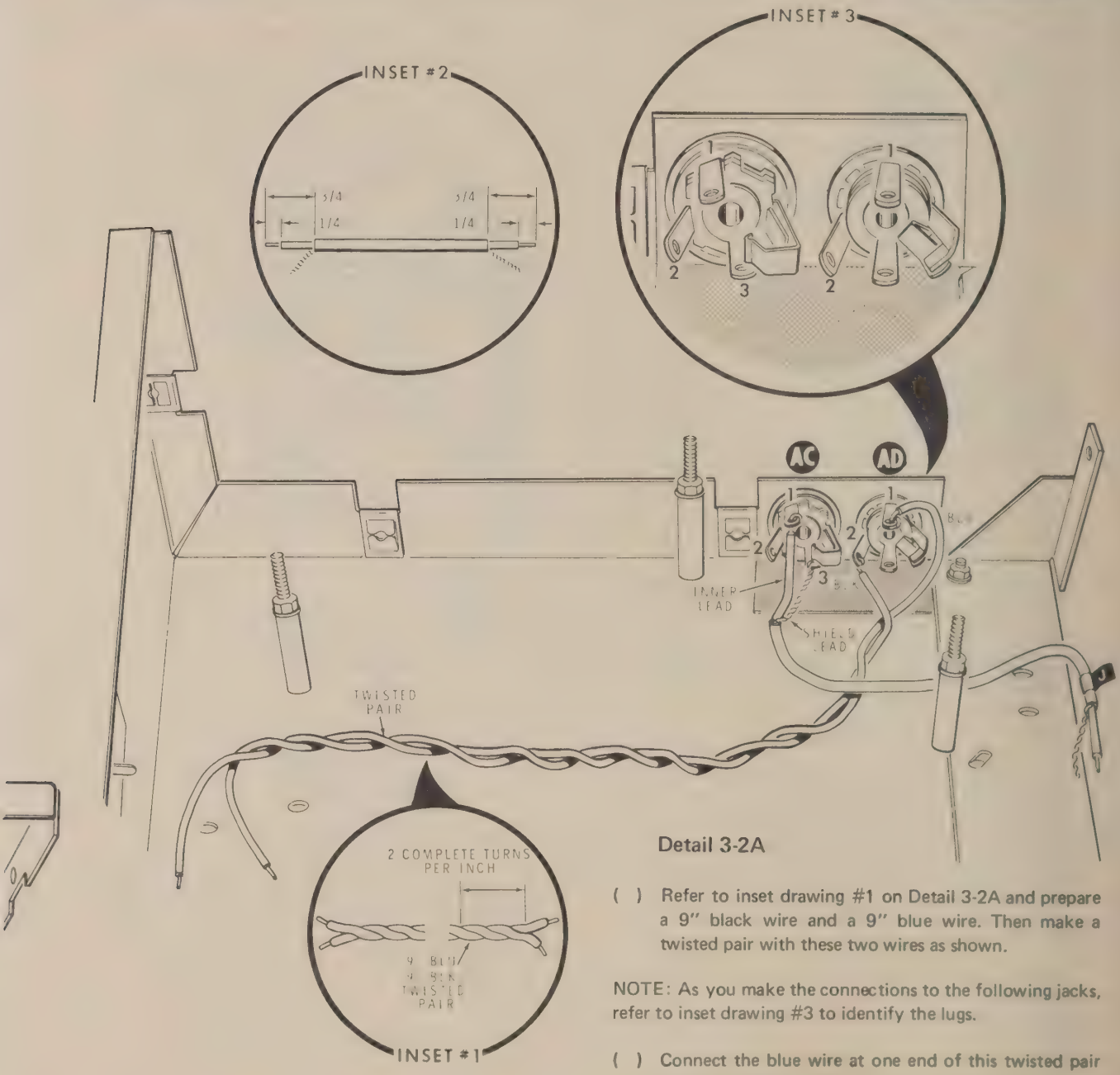
PICTORIAL 3-1



PICTORIAL 3-2



PICTORIAL 3-3



Detail 3-2A

( ) Refer to inset drawing #1 on Detail 3-2A and prepare a 9" black wire and a 9" blue wire. Then make a twisted pair with these two wires as shown.

NOTE: As you make the connections to the following jacks, refer to inset drawing #3 to identify the lugs.

( ) Connect the blue wire at one end of this twisted pair to lug 1 of jack AD (S-1).

( ) Connect the black wire at the same end of the twisted pair to lug 2 of jack AD (S-1).

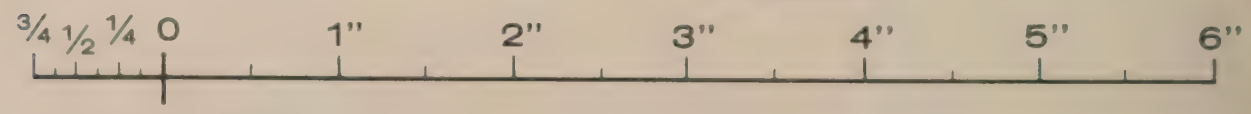
( ) Position the twisted pair as shown. The other end will be connected later.

( ) Prepare a 4-1/2" length of shielded cable as shown in inset drawing #2.

PARTS WIRING

Refer to Detail 3-2A for the following steps.

NOTE: Best results will be obtained in the following step if the wires are twisted approximately two complete turns per inch.

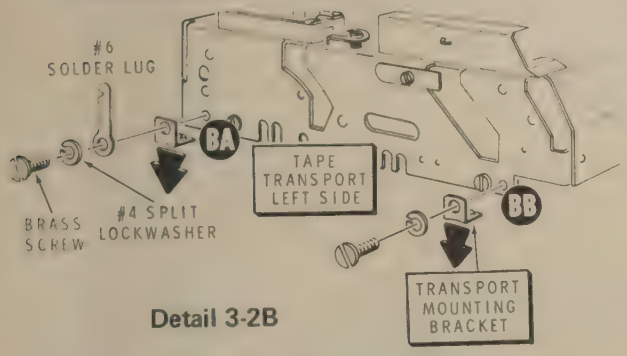


Connect one end of this 4-1/2" cable to jack AC as follows:

( ) Inner lead to lug 1 (S-1).

( ) Shield lead to lug 3 (S-1).

( ) Label the other end of this cable J. It will be connected later.



Detail 3-2B

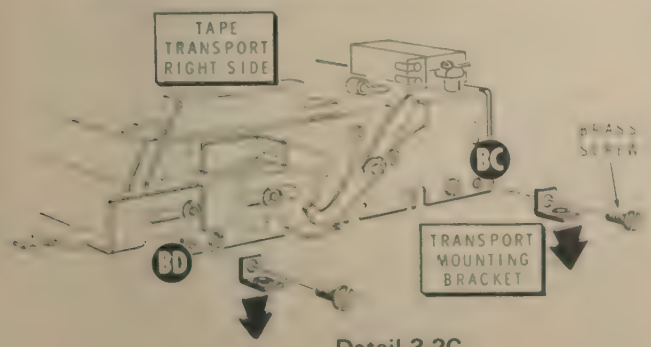
Refer to Detail 3-2B for the following steps.

( ) Unpack the tape transport. There are two bags packed with the transport. One bag contains two knobs and a small screw. Set this bag aside until these parts are called for later. The other bag contains four brass screws. These screws will be used in the following steps.

NOTE: As you install each transport mounting bracket in the next three steps, first start the brass screw in the transport. Then hold the bracket toward the bottom side of the transport and tighten the screw.

( ) Mount a transport mounting bracket on the left side of the tape transport at BA with a #6 solder lug, a #4 split lockwasher, and a brass screw.

( ) Mount another transport mounting bracket on the left side of the tape transport at BB with a #4 split lockwasher and a brass screw.



Detail 3-2C

( ) Refer to Detail 3-2C and mount transport mounting brackets on the right side of the tape transport at BC and BD with brass screws as shown. Note that these two brackets mount the opposite way than the other two brackets and do not require lockwashers.

Refer to Pictorial 3-2 (fold-out from Page 26) for the following steps.

NOTE: In the following steps you will connect three cables from the tape transport to the preamplifier circuit board. Do not shorten any of these cables.

( ) Set the preamplifier circuit board beside the right side of the tape transport as shown.

Connect the wires of the gray-marked cable to the GRY-CBL location on the circuit board as follows:

NOTE: Pull outer insulation back to expose more of the leads if necessary.

( ) Red wire to RED (S-1).

( ) Green wire to GRN (S-1).

( ) Shield wire to S (S-1).

Connect the wires of the orange-marked cable to the ORG-CBL location on the circuit board as follows:

( ) Red wire to RED (S-1).

( ) Twist together the green lead and shield lead. Then connect them to the hole marked GRN-S (S-2).

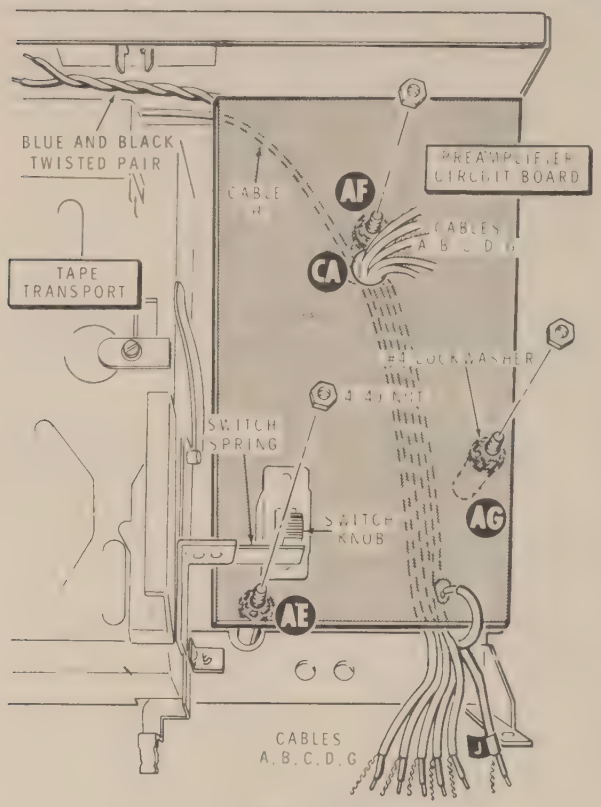
Connect the wires of the unmarked cable to the location of the circuit board shown in the Detail as follows:

( ) Shield wire to S (S-1).

( ) Red wire to RED (S-1).

( ) Green wire to GRN (S-1).

( ) Install a cable tie through the indicated switch hole and around the three tape transport cables as shown.



Detail 3-2D

Refer to Detail 3-2D for the following steps.

NOTE: In the following steps, several cables and wires must be positioned carefully to avoid pinching and crowding. Perform these steps slowly and carefully to be sure the wiring is routed properly.

( ) Install #4 lockwashers on spacers AE, AF, and AG as shown.

NOTE: In the next step, roll the letter tags around the individual cables. This will make it easier to route the cables through the hole.

( ) Route cables A, B, C, D, and G through hole CA in the preamplifier circuit board and position them as shown.

( ) Position cables H and J and the blue and black twisted pair on the chassis as shown.

( ) Lower the preamplifier circuit board onto spacers AE, AF, and AG. Be sure the other cables emerge from the underside of the circuit board as shown.

( ) Secure the preamplifier circuit board to spacers AE, AF, and AG with 4-40 nuts as shown in the Detail.

Refer to Pictorial 3-3 (fold-out from Page 26) for the following steps.

( ) Prepare the following lengths of wire. Remove an extra 1/4" of insulation from one end of each wire.

COLOR	QUANTITY	LENGTH
Red	2	2-1/2"
Red	2	3"
Blue	2	2"
Yellow	2	3"

NOTE: In the next eight steps connect the prepared wires to connector AA. To connect each wire, first slide a ferrite bead over the 1/2" bare end of the wire. Then connect that end of the wire to the large hole of the lug called for in the step. The free end of these wires will be connected later.

( ) 2-1/2" red wire with a ferrite bead to lug 4 (NS).

( ) 2-1/2" red wire with a ferrite bead to lug 4 (NS).

( ) 3" red wire with a ferrite bead to lug 4 (NS).

( ) 3" red wire with a ferrite bead to lug 4 (S-4).

( ) 2" blue wire with a ferrite bead to lug 2 (NS).

( ) 2" blue wire with a ferrite bead to lug 2 (S-2).

( ) 3" yellow wire with a ferrite bead to lug 1 (NS).

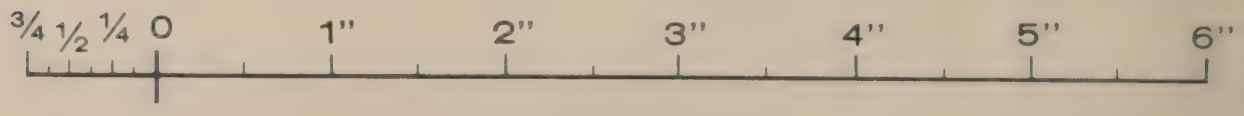
( ) 3" yellow wire with a ferrite bead to lug 1 (S-2).

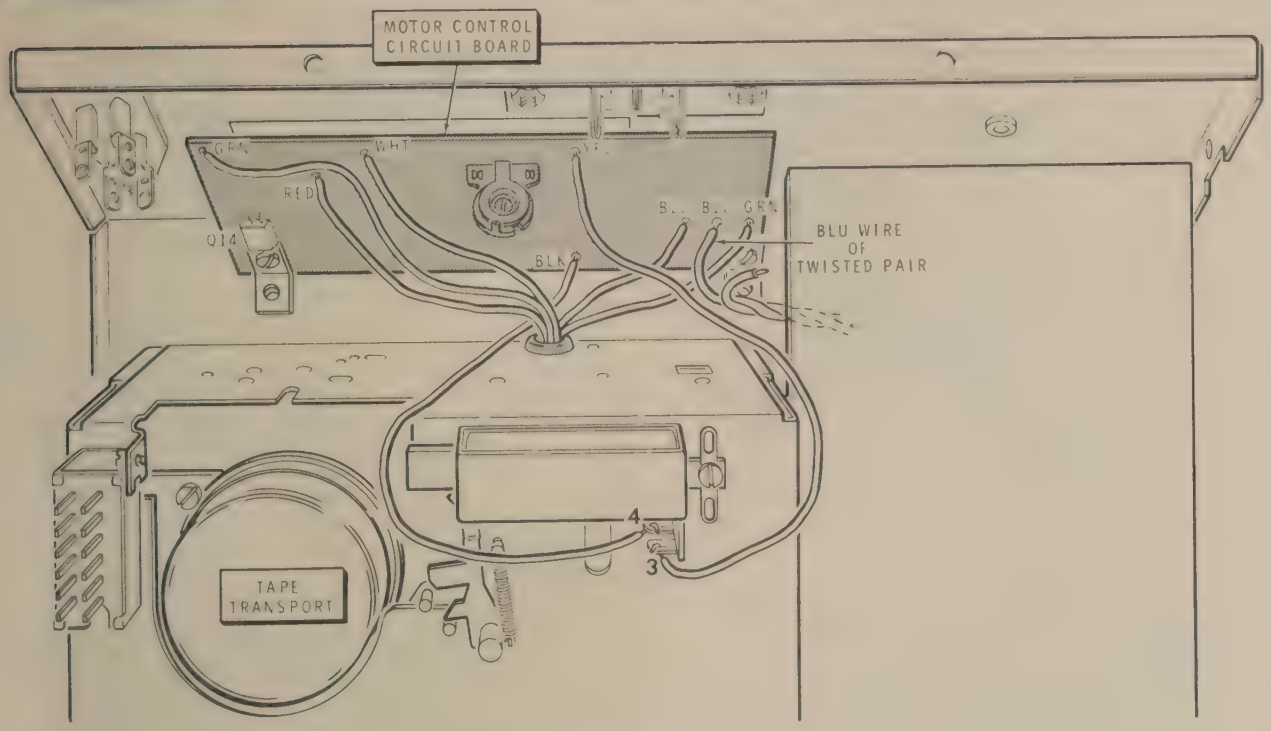
( ) Prepare a 5-1/2" black wire. Connect one end of this wire to the large hole in lug 3 of connector AA (NS).

( ) Prepare a 2" black wire. Connect one end of this wire to the large hole in lug 3 of connector AA (S-2).

Refer to Detail 3-3A for the following steps.

NOTE: Do not shorten any of the wires in the following steps.





Detail 3-3A

Connect the wires coming from the tape transport to the motor control circuit board as follows:

( ) Either green wire to the GRN location nearest Q14 (S-1).

( ) Red wire to the hole marked RED (S-1).

( ) White wire to the hole marked WHT (S-1).

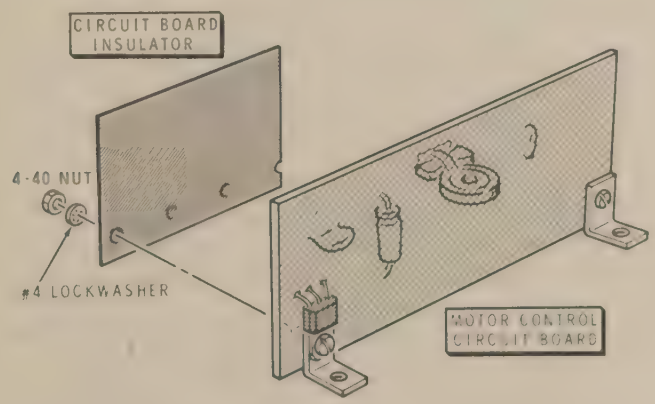
( ) Black wire to the hole marked BLK (S-1).

( ) Yellow wire to the hole marked YEL (S-1).

( ) Blue wire to either hole marked BLU (S-1).

( ) Remaining green wire to the remaining hole marked GRN (S-1).

( ) Connect the blue wire of the blue and black twisted pair coming from jack AD to the remaining circuit board hole marked BLU (S-1).

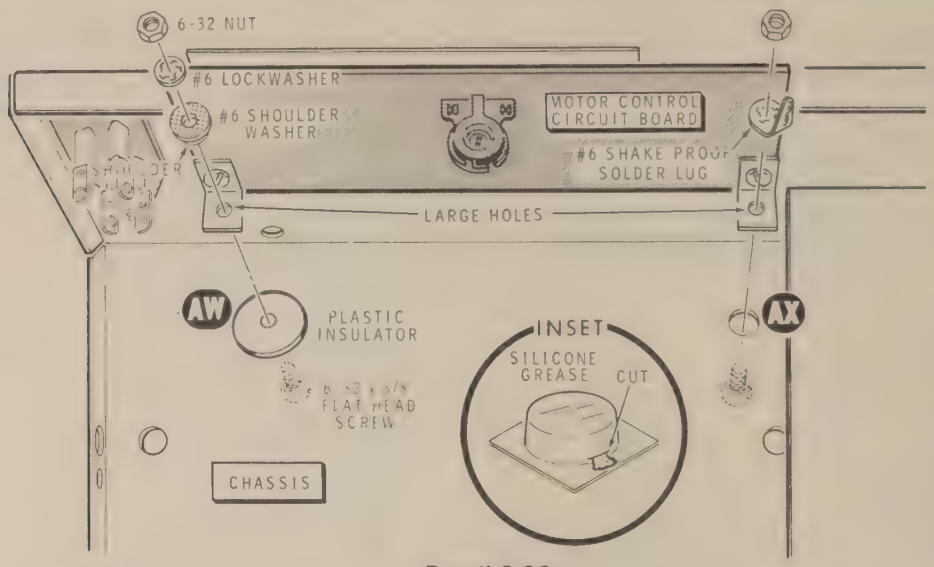


Detail 3-3B

Refer to Detail 3-3B for the following steps.

( ) Remove the 4-40 nut and #4 lockwasher from the screw holding transistor Q14 and the mounting bracket in place. Do not remove the screw.

( ) Install the circuit board insulator on the screw as shown in the Detail. Then reinstall the #4 lockwasher and 4-40 nut on the screw. NOTE: This insulator is the one which was cut in a previous step.



Detail 3-3C

Refer to Detail 3-3C for the following steps.

NOTE: The silicone grease is used to help transfer the heat from the transistor to the chassis. After you apply the grease, discard the remaining grease and wash your hands to avoid getting grease on other parts.

( ) Locate the silicone grease pod and cut it as shown in the inset drawing in the Detail. Then apply a generous amount of grease to both sides of the transistor insulator and center the insulator over hole AW on the chassis as shown.

NOTE #1: When picking up the chassis, pick up the chassis and tape transport together. This will prevent the transport from sliding around.

NOTE #2: Make sure you do not pinch any wires between the brackets and chassis in the next steps.

( ) Mount the left end of the motor control circuit board to the chassis at AW. Use a 6-32 x 3/8" flat head screw, a #6 fiber shoulder washer, a #6 lockwasher, and a 6-32 nut. Make sure the shoulder of the fiber washer seats properly in the bracket hole.

( ) Mount the right end of the motor control circuit board to the chassis at AX. Use a 6-32 x 3/8" flat head screw, a #6 shakeproof solder lug, and a 6-32 nut. Position the solder lug as shown.

Refer to Pictorial 3-3 (fold-out from Page 26) for the following steps.

( ) Connect the black wire of the twisted pair to the bottom hole of the solder lug at AX as shown in Pictorial 3-3 (NS).

( ) Connect the long black wire coming from lug 3 of connector AA to the bottom hole of solder lug AX (S-2).

( ) Connect a 3-1/2" black wire from lug 2 on the tape transport (NS) to the top hole of solder lug AX (NS).

( ) Connect the black wire coming from the preamplifier circuit board to the top hole of solder lug AX (S-2).

( ) Cut the shield lead off the free ends of cables E and F.

( ) Connect the inner lead of cable E to lug 3 of phono socket AB (S-1).

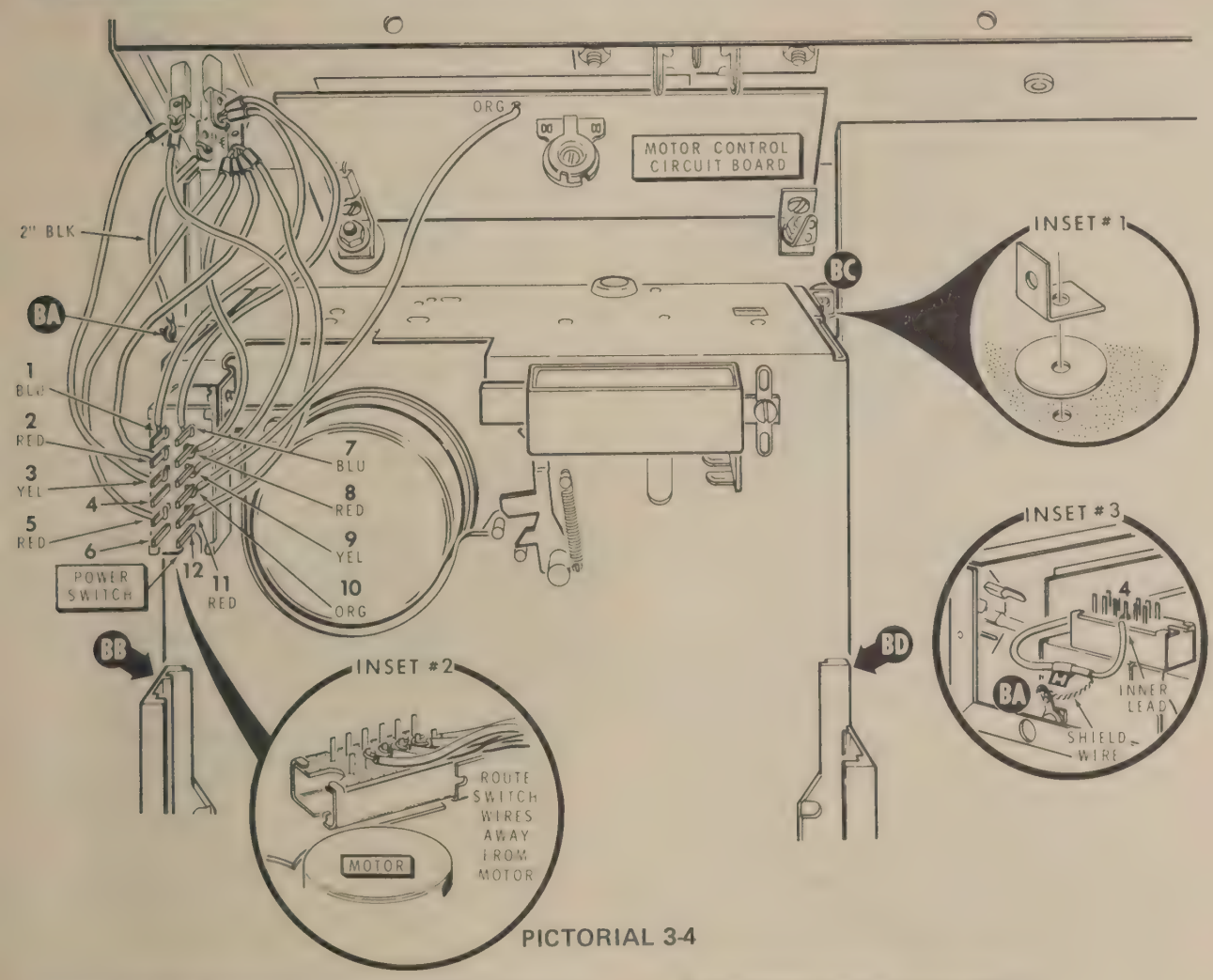
( ) Connect the inner lead of cable F to lug 1 of phono socket AB (S-1).

( ) Connect a 3" black wire from lug 2 of socket AB (S-1) to lug 2 on the tape transport (S-2).

( ) Refer to Pictorial 3-4 for the following steps.

( ) Mount the tape transport to the chassis at BB and BD with 6-32 x 1/4" flat head screws.

( ) Mount the tape transport at BA and BC with 6-32 x 1/4" flat head screws and #10 flat washers. The washers must go between the bracket and chassis as shown in inset drawing #1.



PICTORIAL 3-4

Connect the wires coming from connector AA to the power switch on the tape transport as follows:

( ) Either blue wire to lug 7 (S-1).

( ) Other blue wire to lug 1 (S-1).

( ) Either short red wire to lug 8 (S-1).

( ) Remaining short red wire to lug 2 (S-1).

( ) Either yellow wire to lug 9 (S-1).

( ) Other yellow wire to lug 3 (S-1).

( ) Either long red wire to lug 11 (S-1).

( ) Remaining long red wire to lug 5 (S-1).

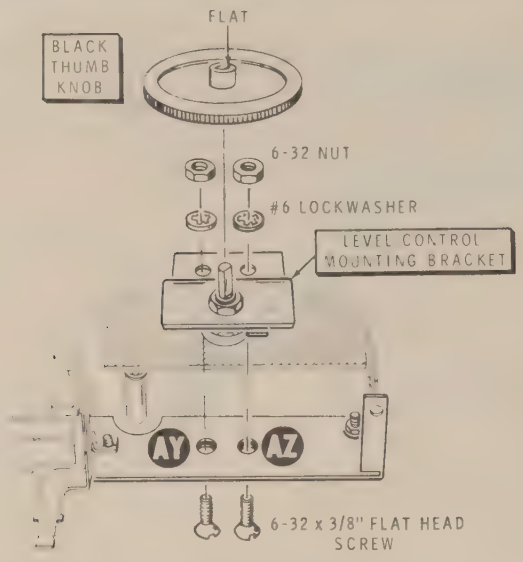
( ) 2" black wire to solder lug BA (NS).

( ) Connect the orange wire coming from the motor control circuit board to lug 10 of the transport power switch (S-1).

( ) Be sure the wires are positioned away from the motor as shown in inset drawing #2 on the Pictorial.

( ) Connect the inner lead of cable H to lug 4 of the power switch on the transport (S-1). See inset drawing #3.

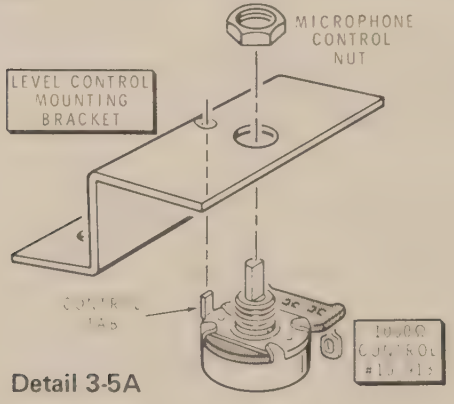
( ) Connect the shield wire of cable H to solder lug BA (S-2). See inset drawing #3.



PICTORIAL 3-5

Refer to Pictorial 3-5 for the following steps.

( ) Mount the 1000 Ω control (#10-913) on the level control mounting bracket with a microphone control nut as shown in Detail 3-5A. Position the control tab as shown.



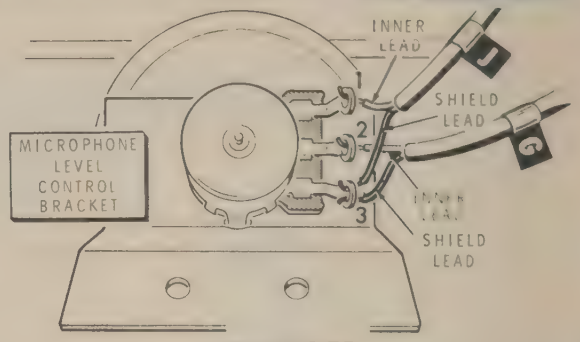
Detail 3-5A

Refer to Detail 3-5B for the following steps.

( ) Remove a 6" length of insulation from the black wire. This insulation will be used on the shield leads of cables and capacitor leads. Save the bare wire.

( ) Cut two 1/2" lengths of black insulation. Then install these lengths on the shield leads of cables G and J.

Position the microphone level control bracket in front of the chassis as shown. Connect cables G and J in the following steps.



Detail 3-5B

( ) Connect the inner lead of cable G to lug 2 (S-1) and the shield lead to lug 3 (NS).

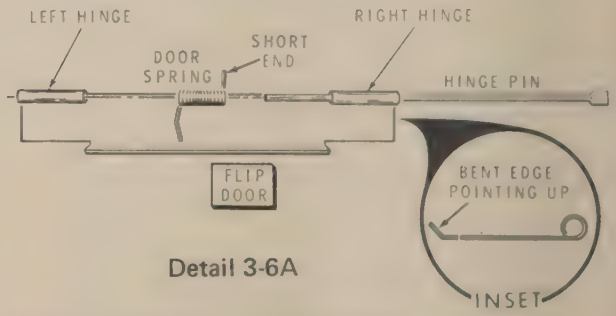
( ) Connect the inner lead of cable J to lug 1 (S-1) and the shield lead to lug 3 (S-2).

NOTE: Push the excess length of cables G and J under the preamplifier circuit board in the next step.

NOTE: After you mount the bracket in the following step, make sure it is parallel with the front of the chassis before tightening the hardware.

( ) Mount the microphone level control bracket on the chassis at AY and AZ as shown in the Pictorial. Use 6-32 x 3/8" flat head hardware. Tighten the hardware just finger tight.

( ) Install the black thumb knob on the microphone level control shaft as shown.

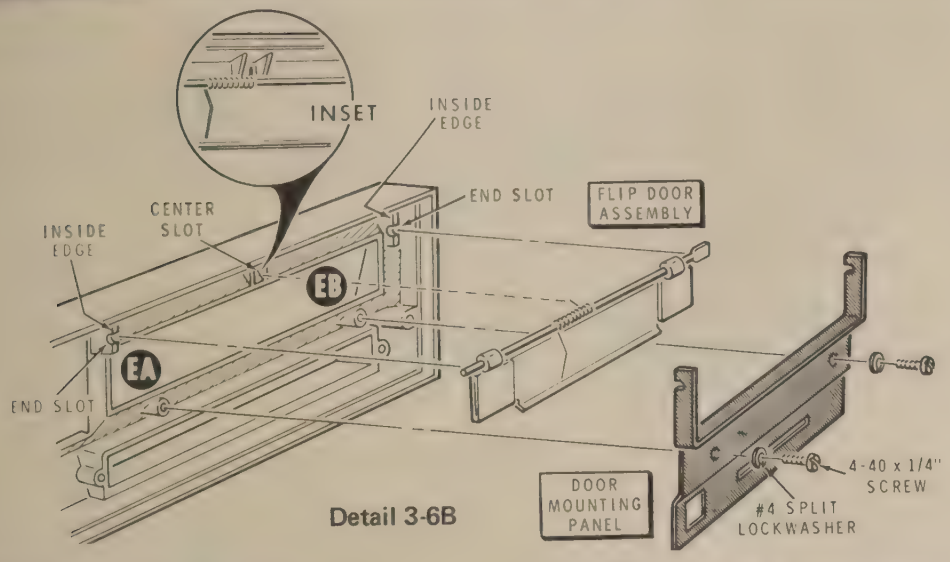


Detail 3-6A

Refer to Detail 3-6A for the following steps.

( ) Position the flip door so the bent edge is pointing up as shown in the inset drawing.

( ) Push the hinge pin through the right hinge of the door. Then position the door spring so the short end is pointing out as shown. Insert the pin through the spring and the left hinge.



Detail 3-6B

Refer to Detail 3-6B for the following steps.

( ) Lay the door on the inside of the front panel so the hinge pin is in the two end slots and the short end of the spring is in the center slot. See the inset drawing.

( ) Place the door mounting panel over the hinge so the panel fits on the inside edge of the end slots. Then mount the panel to the front panel with 4-40 x 1/4" screws and #4 split lockwashers at EA and EB.

( ) Check the door to see if it closes all the way. If it does not, bend the long end of the spring slightly to put more tension on the door.

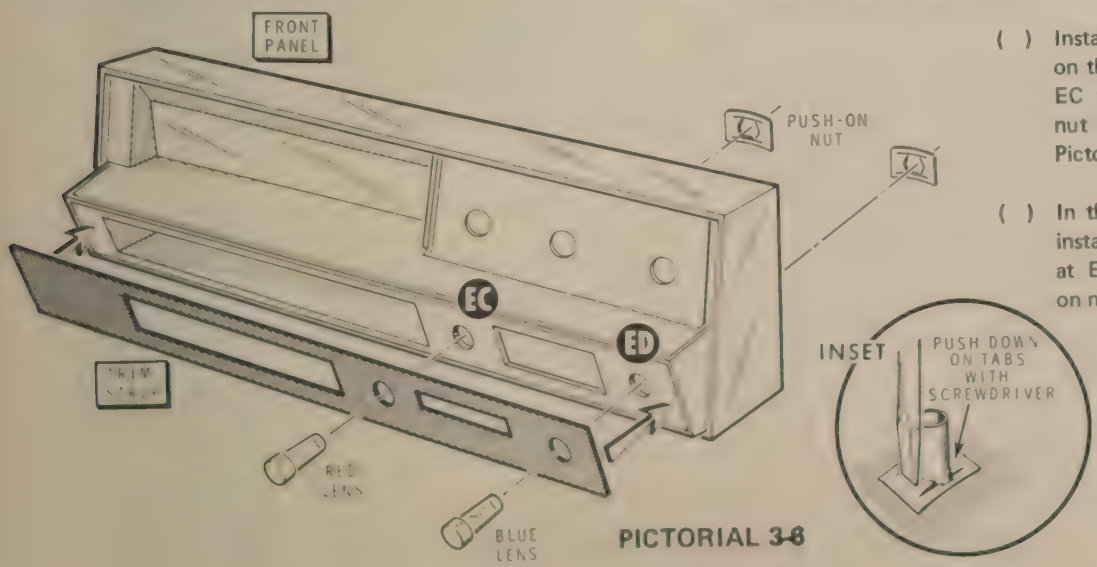
Refer to Pictorial 3-6 for the following steps.

( ) Moisten a soft cloth with rubbing alcohol or an equivalent solvent and clean the area of the front panel where the trim strip will be installed. This area must be clean of all dirt or fingerprints so the adhesive backing on the trim strip will stick properly.

NOTE: Perform the following step carefully to avoid bending the trim strip.

( ) Carefully peel the backing off the trim strip. Then install this strip on the front panel as shown in the Pictorial.

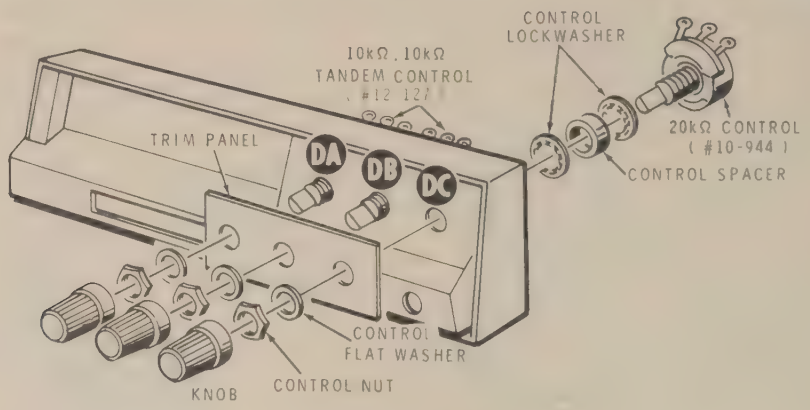
NOTE: In each of the next two steps, use the blade of a screwdriver to press the push-on nuts flat against the inside surface of the front panel as shown in the inset drawing.



PICTORIAL 3-6

( ) Install the red lens on the front panel at EC with a push-on nut as shown in the Pictorial.

( ) In the same manner install the blue lens at ED with a push-on nut.



PICTORIAL 3-7

Refer to Pictorial 3-7 for the following steps.

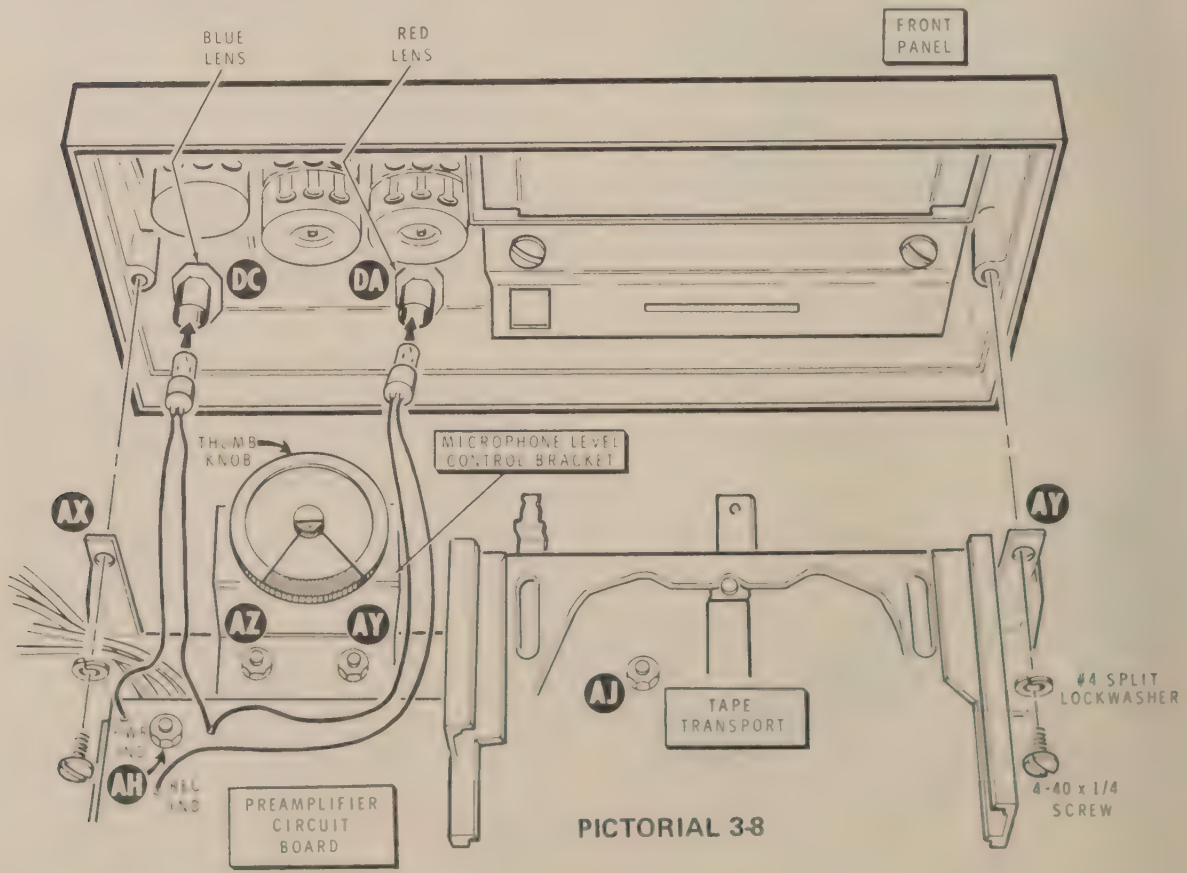
NOTE: When you mount the following controls, position them so the lugs are pointing up.

( ) Mount the trim panel and the 20 kΩ control at DC. Use two control lockwashers, a control spacer, a control flat washer, and a control nut.

( ) Similarly mount one 10 kΩ, 10 kΩ tandem control at DA and the other one at DB.

( ) Push the knobs onto the control shafts.

Refer to Pictorial 3-8 for the following steps.



PICTORIAL 3-8

NOTE: When you install the following lamps, press against the lenses so they will not be pushed out of the front panel.

( ) Push the lamp coming from REC IND on the preamplifier circuit board in the red lens as shown. Route these wires under control DA.

( ) Push the lamp coming from PWR IND on the preamplifier circuit board in the blue lens as shown. Route these wires under control DC.

( ) Mount the front panel on this chassis at AX and AY with 4-40 x 1/4" screws and #4 split lockwashers as shown.

( ) Tighten the two screws on the chassis bottom at AH and AJ.

( ) If necessary, reposition the microphone level control bracket so the thumb knob fits properly in the front panel slot. Then tighten the screws at AZ and AY. NOTE: Also, you may wish to temporarily loosen and slightly reposition the tape transport.

( ) Fold the lamp wires together neatly and lay them on the circuit board.

Refer to Pictorial 3-9 for the following steps.

( ) Locate the black insulation used in previous steps.

( ) Cut the leads of two .1 μF disc capacitors to 3/4". Then place 1/2" lengths of insulation on the leads.

( ) Connect a .1 μF capacitor from lug 1 of control DC (NS) to lug 3 of control DB (S-1).

( ) Connect the other .1 μF capacitor from lug 3 of control DC (NS) to lug 6 of control DB (S-1).

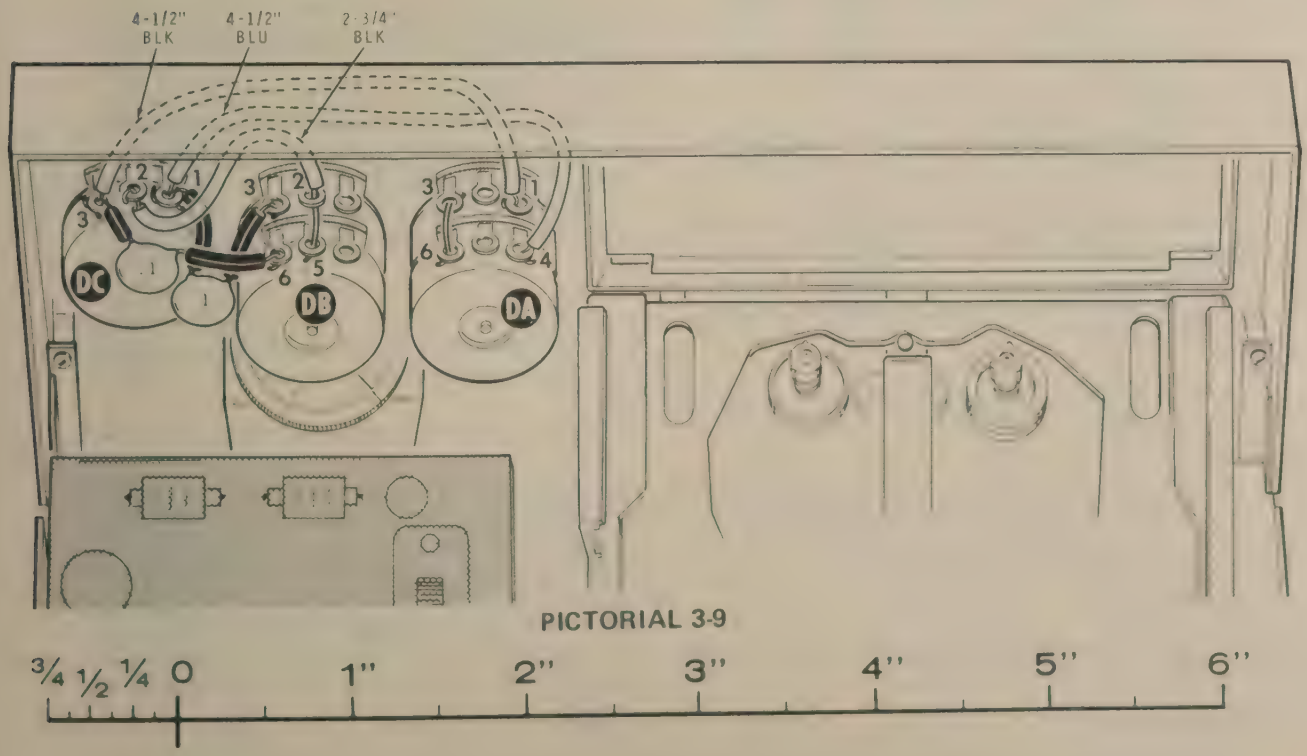
( ) Connect a 4-1/2" black wire from lug 3 of control DC (NS) to lug 1 of control DA (S-1).

( ) Connect a 4-1/2" blue wire from lug 1 of control DC (NS) to lug 4 of control DA (S-1).

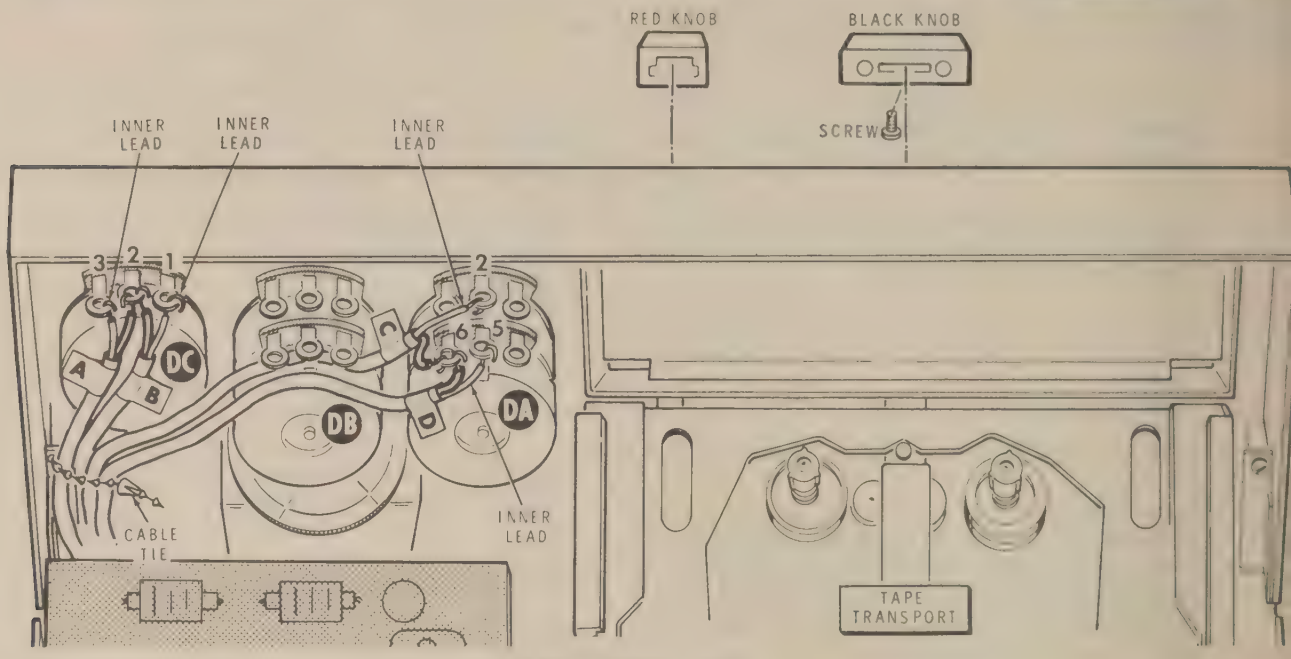
( ) Remove 3/4" of insulation from one end and 1/4" from the other end of a 2-3/4" black wire.

( ) Connect the longer stripped end of this 2-3/4" black wire through lug 2 (S-2) to lug 5 (S-1) of control DB. Connect the other end to lug 2 of control DC (NS).

( ) Connect a 3/4" bare wire between lugs 3 (S-1) and 6 (NS) of DA.



PICTORIAL 3-9



PICTORIAL 3-10

Refer to Pictorial 3-10 for the following steps.

( ) Place a 1/2" length of insulation on the shield lead of each cable.

Connect the cables to the controls in the following steps.

( ) Inner lead of cable A to lug 3 of DC (S-3). Shield lead to lug 2 (NS).

( ) Inner lead of cable B to lug 1 of DC (S-3). Shield lead to lug 2 (S-3).

( ) Inner lead of cable C to lug 2 of DA (S-1). Shield lead to lug 6 (NS).

( ) Inner lead of cable D to lug 5 of DA (S-1). Shield lead to lug 6 (S-3).

( ) Now position cables C and D under the lugs of control DB as shown.

( ) Place a cable tie around the cables at the location shown. Draw the tie tight and cut off the excess.

( ) Make sure none of the control lugs are touching the front panel.

( ) Locate the remaining bag of parts that was supplied with the tape transport.

( ) Position the black knob that was in this bag so the hole-side is pointing down. Push this knob on the center lever of the tape transport until the holes in the knob and lever line up. Then fasten the knob to the lever with the screw that came with the knob.

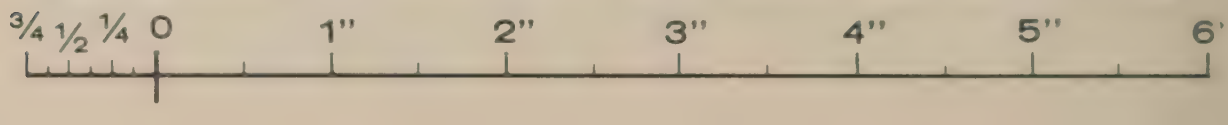
( ) Push the record knob on the other lever.

NOTE: The blue and white label in the next step shows the Model Number and Production Series Number of your kit. Refer to these numbers in any communications with the Heath Company; this assures you that you will receive the most complete and up-to-date information in return.

( ) Carefully peel away the backing paper from the blue and white identification label. Then press the label anywhere underneath the chassis.

Set aside any remaining parts, they will be used later.

This completes the "Step-by-Step Assembly." Carefully inspect all connections for loose or unsoldered wires or leads. Remove any wire clippings or solder splashes. If you have not assembled the CRA-1000-1 Power Amplifier or CRA-1000-2 Speaker System yet, proceed to the Assembly Manuals for those kits. If they have been assembled, proceed to the "Test and Adjustments" section of this Manual.



TEST AND ADJUSTMENTS

Before you proceed with this section of the Manual, consider the following items:

(A) The Power Amplifier Model CRA-1000-1 has to be used and must be assembled if you have not already done so.

(B) A speaker system, either Model CRA-1000-2 or Model CRA-1000-5, will be used.

(C) A DC power supply capable of producing 13.8 volts at 1.5 amperes can be used for these checks. If one is not available, either remove your car battery and complete the test checks on your work bench or leave the battery in your car and connect the power amplifier leads to the ignition switch.

Refer to Figure 1-1 for the following steps.

Connect the leads from the Power Amplifier to the back of the Cassette as follows:

( ) 4-pin plug to socket AA.

( ) Phono plug on yellow lead to phono socket R.

( ) Phono plug on blue lead to phono socket L.

( ) Insert the spade bolts extending from the Power Amplifier into the holes shown on the back of the Cassette Player. Then mount the Amplifier to the Player with 6-32 x 1-3/8" screws, #6 split lockwashers, #6 flat washers, and #6 red fiber washers (supplied with the Power Amplifier).

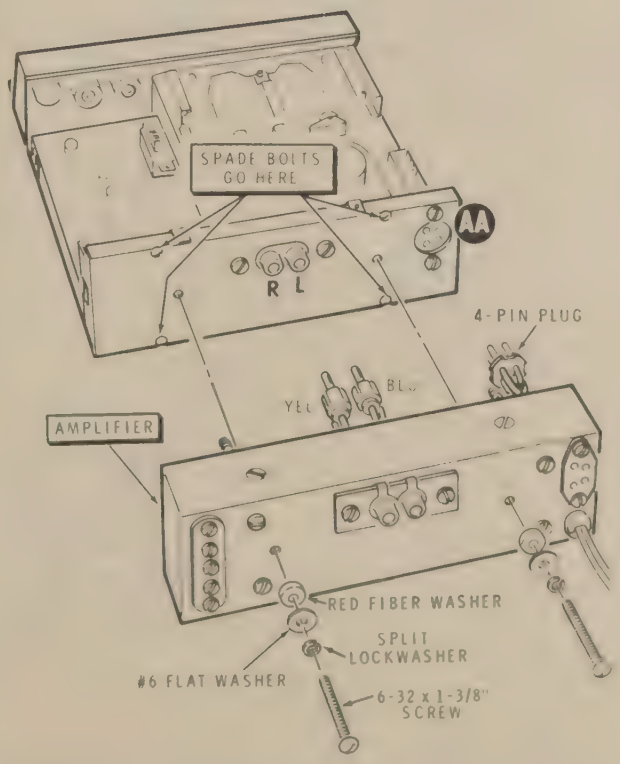


Figure 1-1

Refer to Figure 1-2 for the following steps.

Make the following connections to the Power Amplifier.

( ) Connect the left speaker leads to the LEFT SPKR terminal and the COM terminal.

( ) Connect the right speaker leads to the RIGHT SPKR terminal and the COM terminal.

NOTE: Make the following connections to a power source: a DC power supply, car ignition switch, or 12-volt car battery.

( ) Connect the black lead coming from the Amplifier to the negative (–) terminal of the power source and the red lead to the positive (+) terminal.

Refer to Figure 1-3 for the following steps.

( ) Set the Cassette Controls as follows:

MOTOR SPEED – Center of rotation (use a small 1/8" blade screwdriver).

VOLUME – Center of rotation.

TONE – Center of rotation.

BALANCE – Center of rotation.

REJECT BAR – Center position.

RECORD BAR – Out position.

NOTE: One side of the test tape contains the following information:

1. One minute of a continuous tone.
2. Five seconds blank.
3. One minute of short tones spaced five seconds apart.
4. Five seconds blank.
5. Three minutes of music.
6. Five seconds blank.
7. Three minutes of music.

The other side of the tape is blank for the record check.

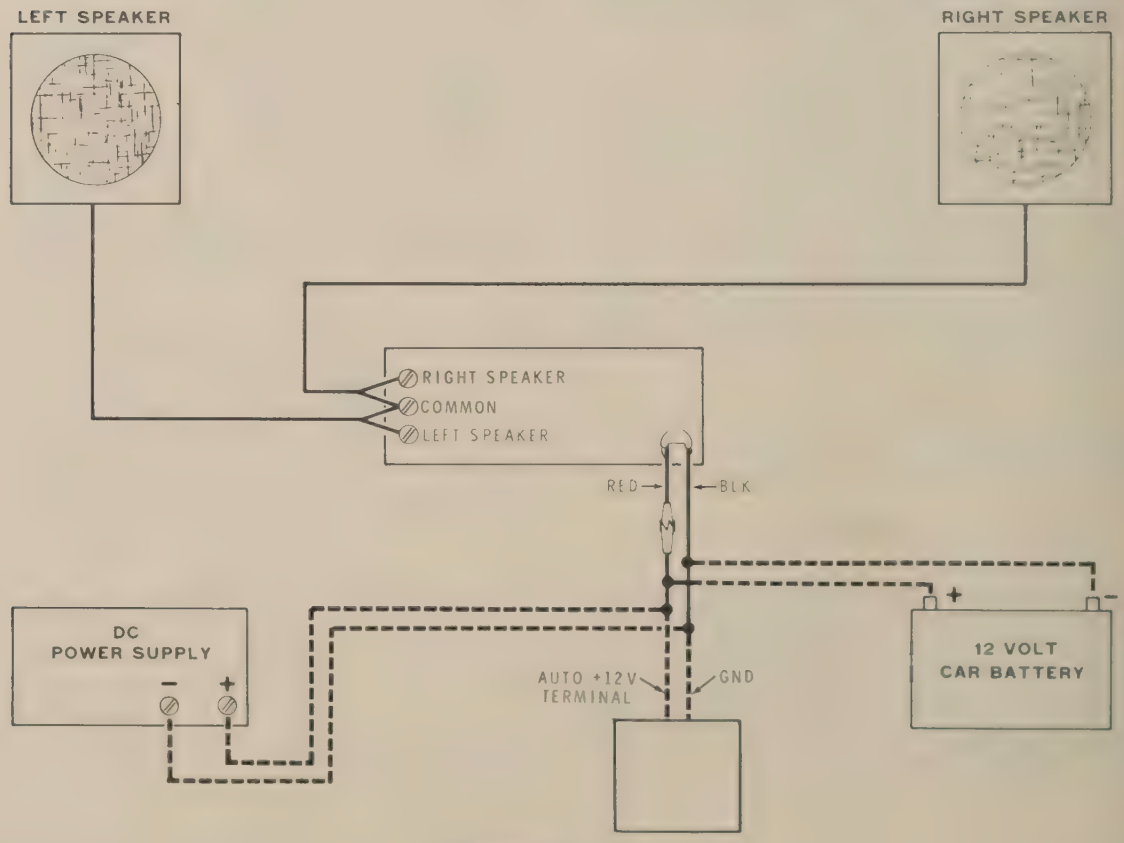


Figure 1-2

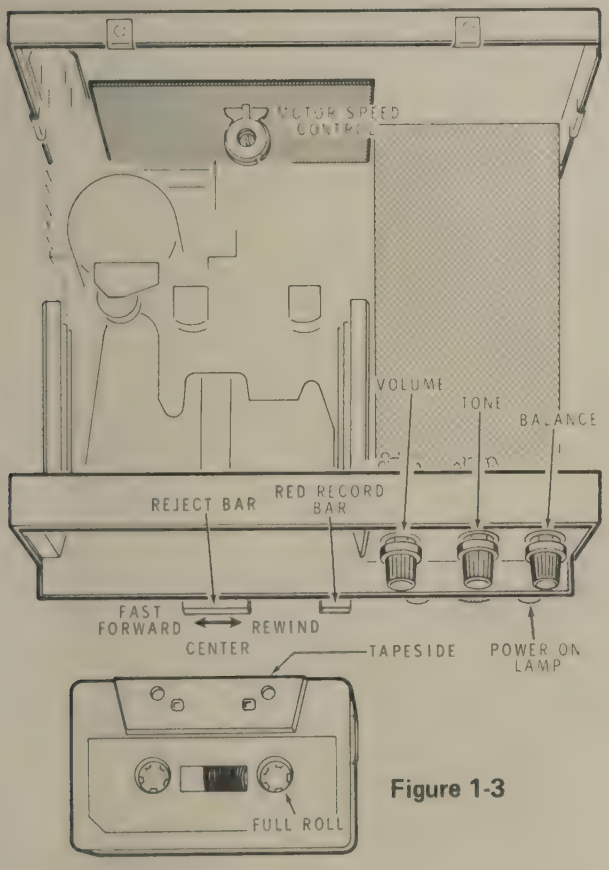


Figure 1-3

Note that the REJECT BAR has a Rewind, a Center, and a Fast Forward position. If you use up the portion of tape you are using for a particular adjustment, move the REJECT BAR to the Rewind position and hold it there until the portion you need has been rewound. Then release the REJECT BAR. Be careful not to push in on the REJECT BAR or the cartridge will reject.

( ) Position the test tape cartridge label-side-up, with the full roll to the right and the visible tape toward the transport.

NOTE: If you do not obtain the proper results in the following steps, push the REJECT BAR in to reject the tape cartridge. Then refer to the "In Case of Difficulty" section on Page 47 of this Manual.

( ) Push the cartridge firmly into the transport. The cartridge should lock into place and the blue lamp should light. Adjust the VOLUME control so the test tone is heard. NOTE: There will be a slight pause while circuit capacitors charge before you hear tape recorded material.

SPEED CONTROL ADJUSTMENT

The test information you will use in the following steps is the one minute of short tones. You will need a watch or clock with a second hand.

( ) Observe the second hand of a watch and adjust the MOTOR SPEED control until the tone is heard at 5 second intervals. If the tones are too close together, turn the control counterclockwise. If the tones are too far apart, turn the control clockwise.

MUSIC CHECK

NOTE: The portion of tape you will use in these steps is the three minutes of recorded music.

( ) Adjust the BALANCE control clockwise; sound should come from the right speaker and not the left speaker. Adjust the control counterclockwise; sound should come from the left speaker and not the right speaker.

( ) Now adjust the BALANCE control until the sound appears to be coming from the center.

( ) Adjust the TONE control clockwise and counterclockwise. Clockwise will increase the "highs" and counterclockwise will decrease the "highs."

RECORD CHECK

( ) Turn the test cartridge over and insert it into the transport.

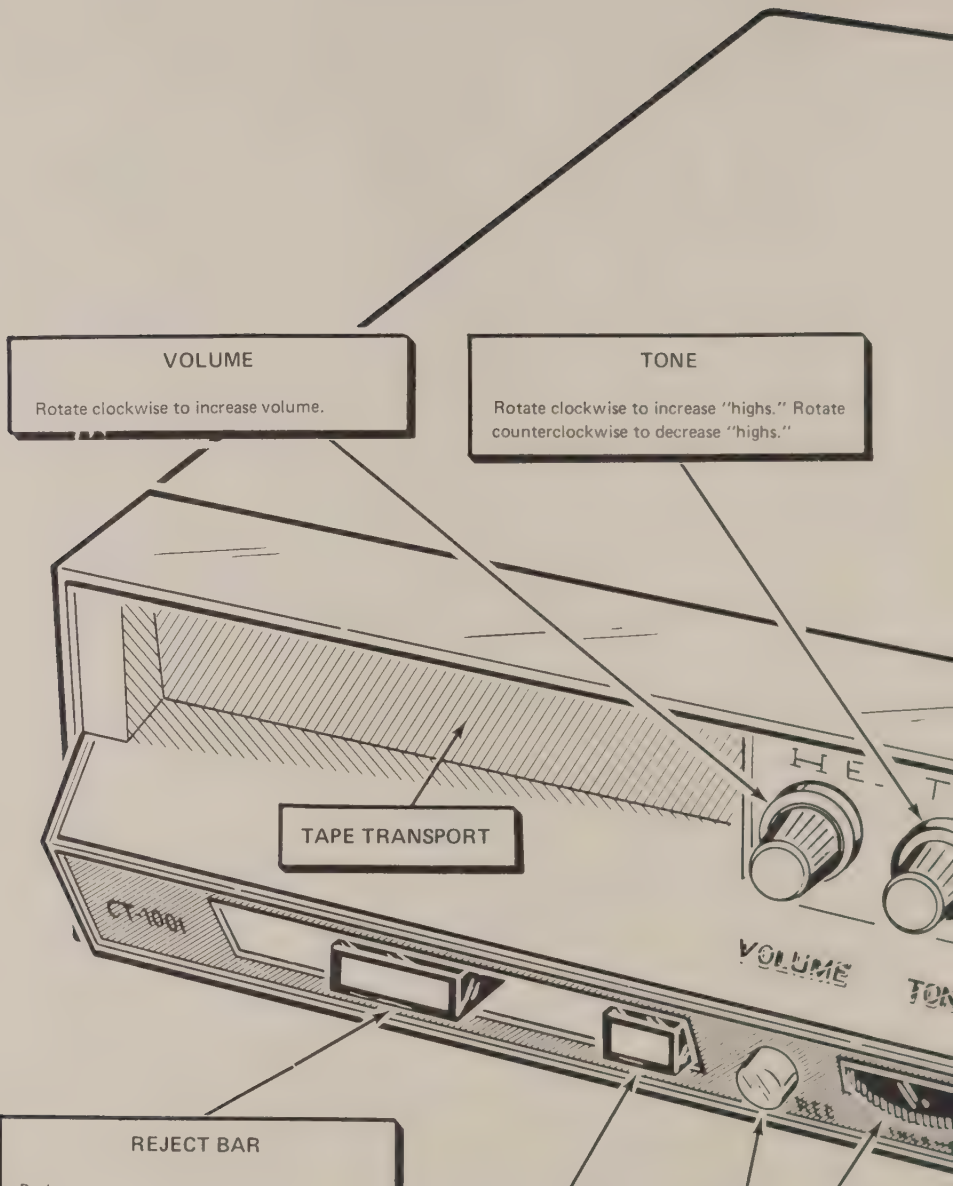
( ) Move the REJECT BAR to the Rewind position and hold it there until the tape is wound on the right reel. When this has occurred, release the bar and let it return to the center position; then push it in to reject the cartridge. Do not remove the cartridge from the transport.

( ) Insert the microphone plugs into their respective jacks on the right-hand side of the Player.

( ) Make sure the microphone switch is in the OFF position.

( ) Push the cartridge until it locks into place.

( ) Hold the REJECT BAR in either the left or right position and push in the RECORD BAR. Then release the REJECT BAR. NOTE: The red light may come on instantaneously.


VOLUME
Rotate clockwise to increase volume.
TONE
Rotate clockwise to increase "highs." Rotate counterclockwise to decrease "highs."
TAPE TRANSPORT
REJECT BAR
Push:
• right to rewind the cartridge.
• left for fast forward wind.
• in to reject the cartridge.
RECORD BAR (To Make a Recording.)
Push in when the REJECT BAR is in the left or right position. Then release the REJECT BAR. After recording, push the REJECT BAR in or left to unlatch the RECORD BAR.
RECORD LEVEL CONTROL AND LAMP
Adjust this control as you start to record until the lamp just starts to flash when you speak into the microphone.

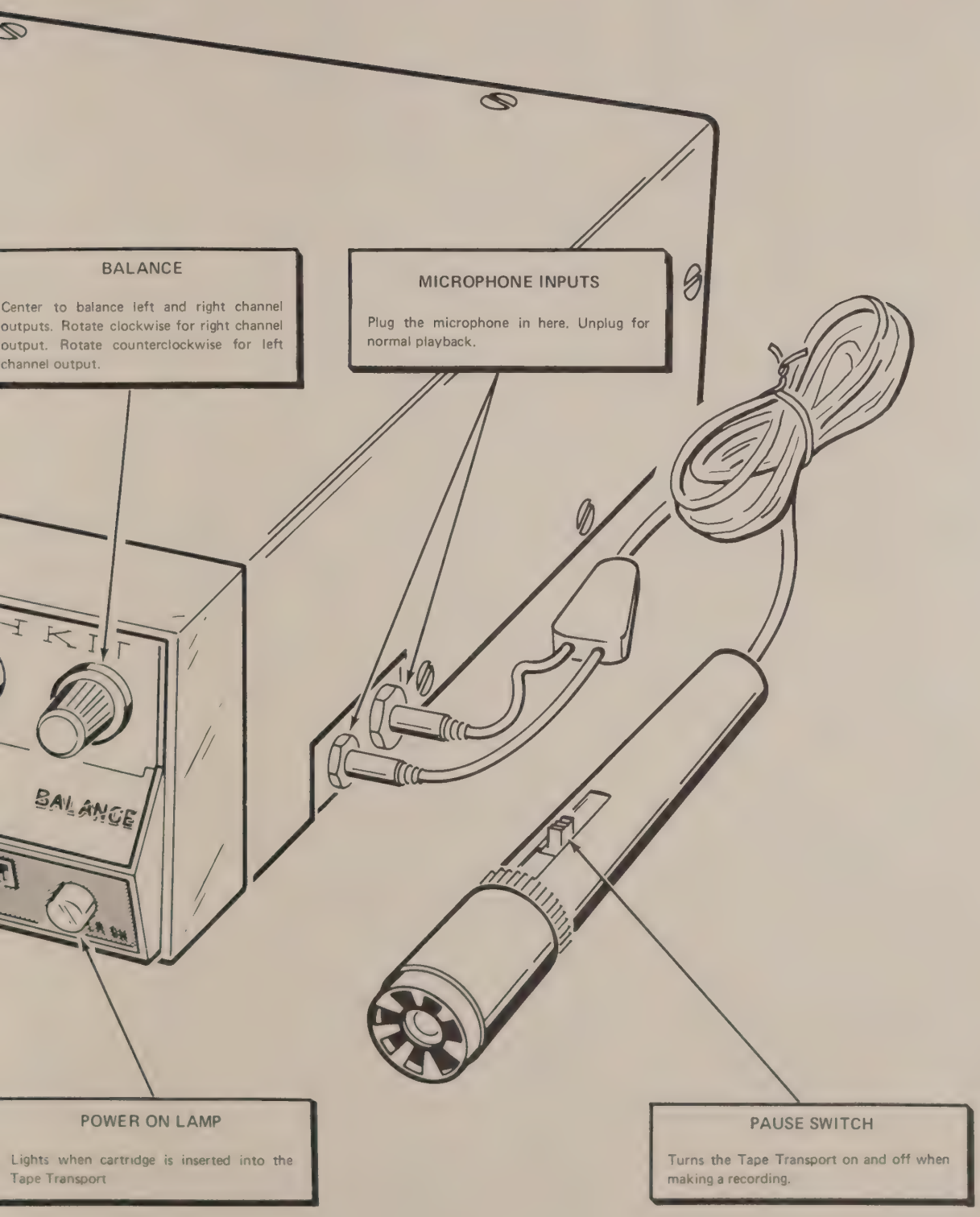

BALANCE
Center to balance left and right channel outputs. Rotate clockwise for right channel output. Rotate counterclockwise for left channel output.
MICROPHONE INPUTS
Plug the microphone in here. Unplug for normal playback.
BALANCE
POWER ON LAMP
Lights when cartridge is inserted into the Tape Transport
PAUSE SWITCH
Turns the Tape Transport on and off when making a recording.

Figure 2-1

NOTE: You are now ready to record. The mechanism will turn on when the microphone switch is pushed to the ON position. The setting of the VOLUME, TONE, and BALANCE controls will have no effect on the recording feature.

( ) Set the REC (record) LEVEL control all the way to the left.

( ) Turn the microphone to ON. Talk into the microphone and adjust the REC LEVEL control to the position that causes the red lamp to just start flashing with voice peaks. Anytime you want to pause in your recording, turn the microphone off. This will stop the tape.

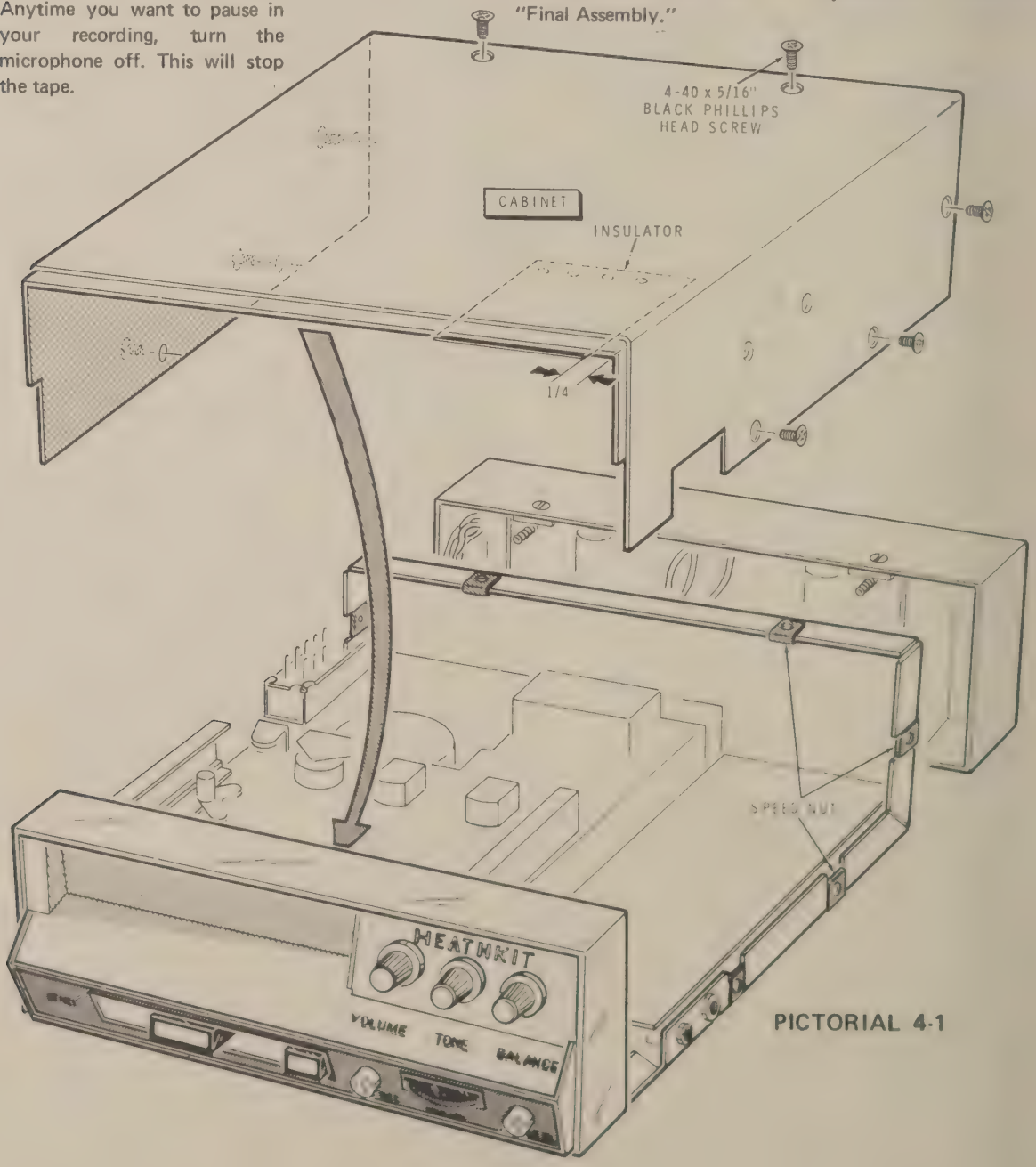
After you have completed your recording, and would like to play the information back, perform the following steps.

( ) Move the REJECT BAR to the left. This will disengage the RECORD BAR.

( ) Move the REJECT BAR to the right to rewind the tape; then release it. Adjust the VOLUME control as needed.

( ) Unplug the microphone leads.

This completes the "Test and Adjustments." Proceed to "Final Assembly."



PICTORIAL 4-1

FINAL ASSEMBLY

Refer to Pictorial 4-1 for the following steps.

( ) Remove and disconnect the Power Amplifier.

( ) Remove the backing paper from the insulator. Then press the insulator on the inside of the cabinet top at the location shown.

( ) Place the cabinet top on the chassis and fasten it with eight 4-40 x 5/16" black phillips head screws.

This completes the "Final Assembly."

At this time, you will have several parts left over. These parts will be used in the installation of the Cassette Player system. The parts that are left are:

PART No.	QUANTITY	DESCRIPTION
73-120	2	Gimbal bracket gasket
250-1161	7	10-32 x 3/8" allen head screw
252-5	3	10-32 nut
253-3	4	#10 fiber washer
253-98	7	#10 flat washer
254-38	3	#10 split lockwasher
204-1299-1	1	Gimbal mounting bracket
205-864-1	2	Interconnector bracket

Refer to the Installation Instruction Sheet at this time. After you have installed your Stereo Cassette Player, return to the "Operation" section of this Manual.

OPERATION

This section of the Manual will help you become more familiar with the operation of your Cassette Player. Figure 2-1 (fold-out from Page 40) gives a brief description of each control function.

LOADING

Insert a cassette cartridge into the Tape Transport with the tape opening first and the full tape reel to the right. The Cassette Player will turn on as the cartridge is inserted. NOTE: For the cartridge to stay latched in the transport and the Player to turn on, the Power Amplifier must be connected to a power source.

Lift up on the cartridge slightly when removing it from the Tape Transport.

PLAY

Adjust the VOLUME, TONE, and BALANCE controls to the desired levels. NOTE: Each time the unit is turned ON, there will be a short delay before you hear normal sound. During this time there may be a tone. This is due to the capacitors charging and does not indicate a problem in the unit.

Use the REJECT BAR to rewind, wind fast forward, or reject the cartridge. The cartridge will also reject when the tape reaches the end of its travel, if the tape hangs-up in the cartridge, or when power is removed from the unit.

RECORD

Any information that was recorded on a tape is automatically erased during the record operation. The record feature is for dictation and records on the left channel only. The microphone switch turns the tape transport motor on and off. Unplug the microphone for normal play operation.

Insert a cassette cartridge into the Tape Transport with the full reel to the right.

Push the REJECT BAR to the left or right position and hold it there. Press in and hold the RECORD BAR and release the REJECT BAR. Then release the RECORD BAR.

Adjust the RECORD LEVEL control until the RECORD LEVEL lamp just blinks when you speak into the microphone. Then rotate the control to the right 1/8 turn.

When the recording is finished, either push the REJECT BAR right to rewind the tape or push it in to reject the cartridge.

ERASE

If you wish to erase a tape without recording any new information on it, follow the "Record" procedure except turn the RECORD LEVEL control fully to the left.

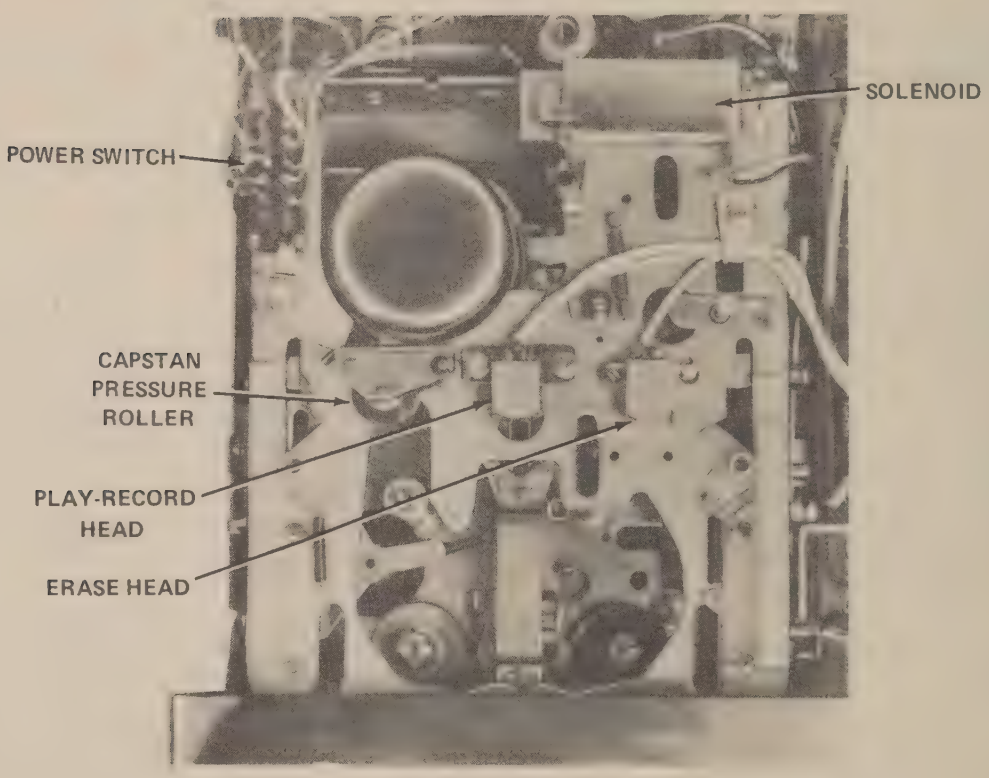

SOLENOID
POWER SWITCH
CAPSTAN PRESSURE ROLLER
PLAY-RECORD HEAD
ERASE HEAD

Figure 2-2

MAINTENANCE

Refer to Figure 2-2 while you read this section.

Accumulations of tape residue and other foreign matter from normal use can affect the performance of your Cassette Player. This can cause "wow" and "flutter," impaired erasure, and a reduction in volume and high frequency response. The residue collects on the capstan, capstan pressure roller, the erase head surface, and the record-play head surface. Perform the following cleaning procedure after every 100 hours of operation to insure peak performance of your Cassette Player.

CLEANING

Remove the cassette cartridge. Moisten a cotton swab with methyl alcohol and gently clean the front surface of both heads (see caution notes below). Also clean the capstan and its pressure roller.

CAUTION

1. Use methyl alcohol only. Do not saturate the swab with alcohol, dampening it is sufficient. Other volatile solvents might damage the heads by dissolving the encapsulating compounds surrounding the head pole pieces.

2. Do not use a sharp or metallic object, or a brush with a metallic band around the bristles to clean the heads. The highly polished pole pieces and delicate head gaps can easily be damaged by these materials.

MAGNETISM

Magnetism may build up in the tape heads after long use. This will cause an increase in noise level on your tapes during playback. It is recommended that the heads be demagnetized about as often as you clean the heads (approximately every 100 hours). Tape head demagnetizers can be purchased from your local hi-fi dealer. Follow the instructions that come with the demagnetizer.

IN CASE OF DIFFICULTY

Begin your search for any difficulty by carefully following the steps listed in the "Visual Tests" section. After visual tests are completed, refer to the "Troubleshooting Charts." If by this time you are unable to correct your difficulty, refer to the "Circuit Board X-Ray Views"on Pages 67 and 68.

Refer to the "Circuit Board X-Ray Views" to locate parts on the circuit boards.

VISUAL TESTS

1. Recheck the wiring. Trace each lead in colored pencil on the Pictorial as it is checked. It is frequently helpful to have a friend check your work. Someone who is not familiar with the unit may notice something consistently overlooked by the kit builder.

2. About 90% of the kits that are returned to the Heath Company for repair do not function properly due to poor connections and soldering. Therefore, many troubles can be eliminated by reheating all connections to make sure that they are soldered as described in the "Soldering" section of the "Kit Builders Guide."

3. Check to be sure that all transistors are in their proper locations. Make sure each transistor lead is connected to the proper hole in the circuit board. NOTE: A transistor will not operate if it is incorrectly installed.

4. Check all diodes against the "Circuit Board X-Ray Views" on Page 67 and 68. Be sure the banded end of the diode is positioned properly. NOTE: A diode will not operate if it is installed incorrectly.

5. Check capacitor values carefully. Be sure the proper part is wired into the circuit at each capacitor location. For example, it would be easy to mistake a .001 μF capacitor for a 100 pF capacitor. Check each electrolytic capacitor to be sure the lead near the positive (+) marking is at the correct position.

6. Check each resistor value carefully. It would be easy, for example, to install a 2200 Ω (red-red-red) resistor where a 220 Ω (red-red-brown) resistor is called for. A resistor that is discolored, or cracked, or shows any sign of bulging would indicate that it is faulty and should be replaced.

7. Check for bits of solder, wire ends, or other foreign matter which may be lodged in the wiring.

8. Read the "Circuit Description." It may also help you determine where the trouble is located.

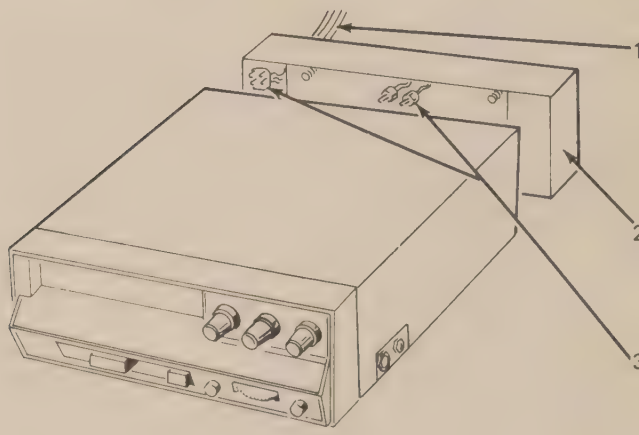
9. Refer to Page 48 for important servicing information.

NOTE: In an extreme case where you are unable to resolve a difficulty, refer to the "Customer Service" information inside the rear cover of the Manual. Your Warranty is located inside the front cover.

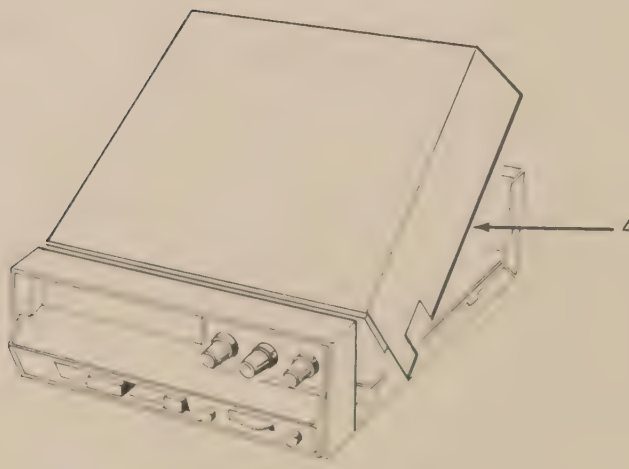
CIRCUIT BOARD AND TRANSPORT REMOVAL FOR SERVICING

NOTE: The circuit boards must be removed if they have to be serviced. To remove a circuit board, refer to the proper group of steps that follow. Then carefully inspect the circuit board foil for solder bridges (solder that has bridged across two foils or between two lugs). Compare the foil on the circuit board to the foil shown in the "Circuit Board X-Ray Views" on Pages 57 and 58 to help locate solder bridges. Be especially watchful of solder bridges around the slide switch. Be careful not to let the circuit boards touch anything that could short the foils together. After the circuit boards have been serviced, reinstall them as shown in the "Step-by-Step Assembly."

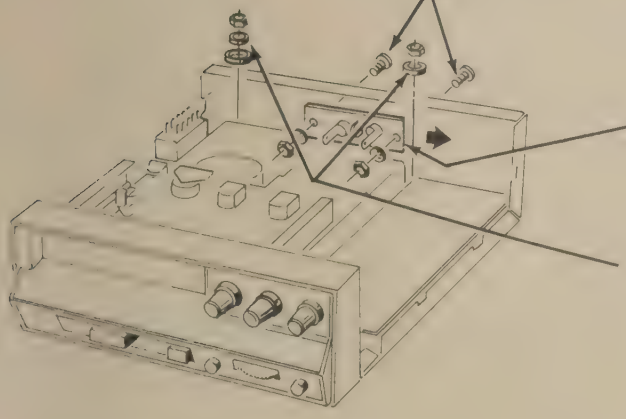
MOTOR CONTROL CIRCUIT BOARD SERVICING



1. Disconnect these wires from power source.
2. Remove power amplifier.
3. Unplug these plugs.



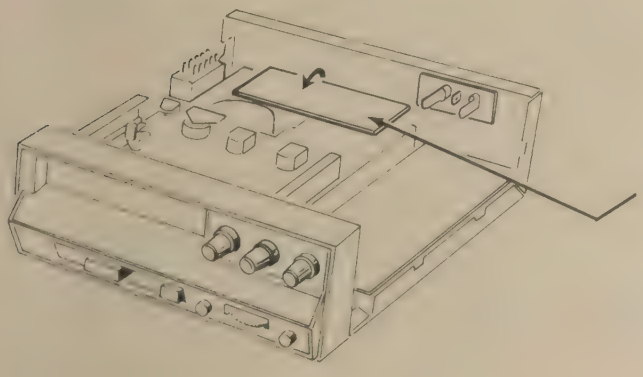
4. Remove the cover.



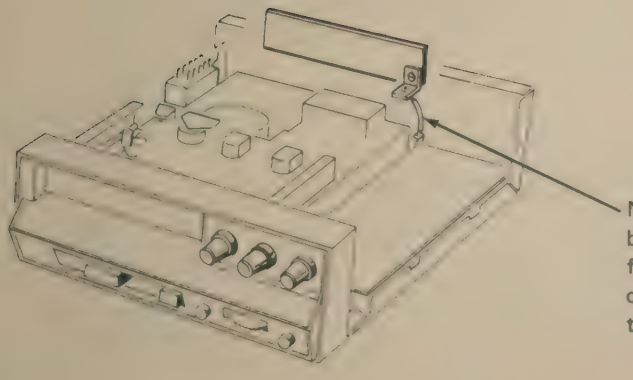
5. Remove this hardware.

6. Move the phono socket to the right.

7. Remove this hardware.

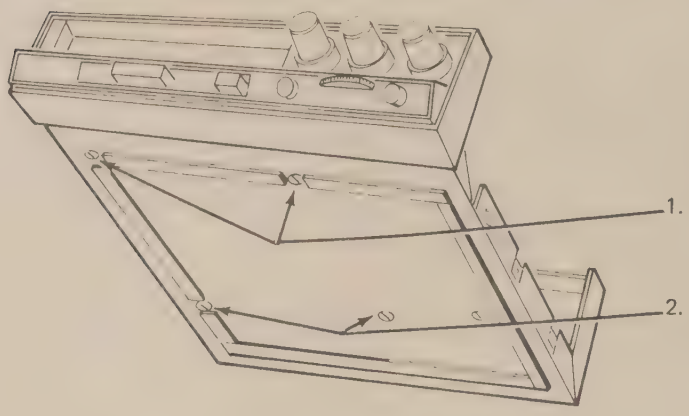


8. Position the motor control circuit board foil-side-up on top of the tape transport for servicing.



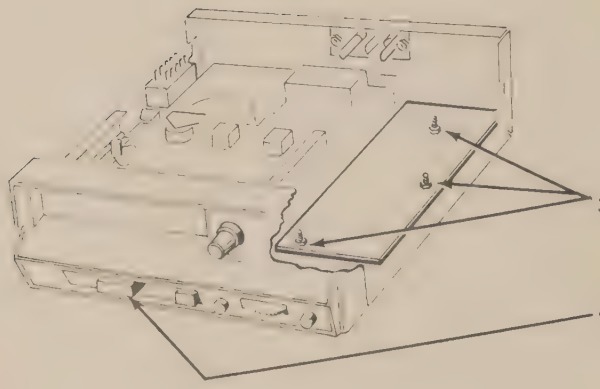
NOTE: To make the motor control circuit board operational while it is not mounted, first reconnect the power amplifier. Then connect a jumper wire from this bracket to the chassis.

PREAMPLIFIER CIRCUIT BOARD SERVICING



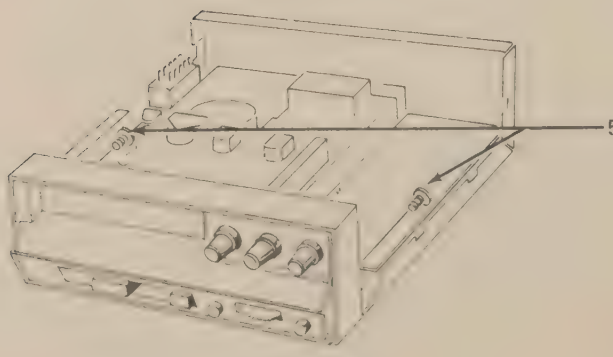
1. Remove these screws.

2. Remove these screws and flat washers.

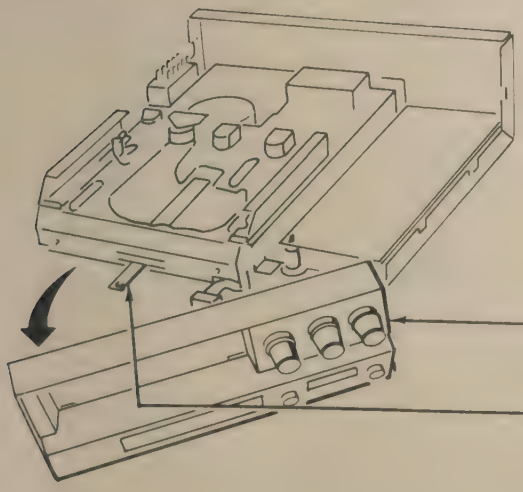


3. Remove these nuts.

4. Remove this screw. Then remove the black knob by placing a cloth around and behind it and gently pulling forward. Do not remove the red knob.

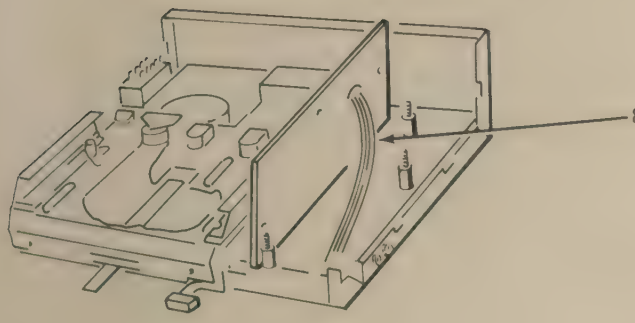


5. Remove these screws.



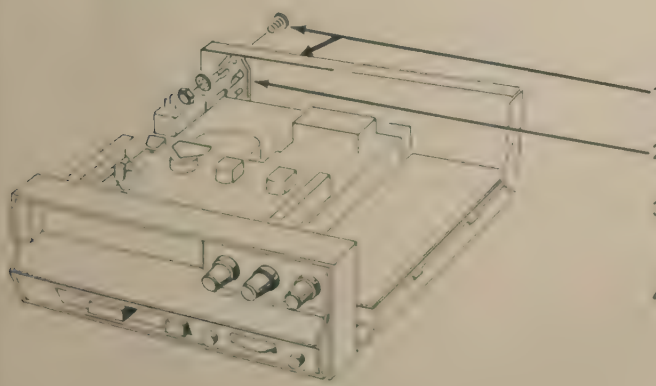
6. Swing the front panel out. The lamps will pull out of the lenses.

7. Slide the tape transport forward as far as possible.



8. Tilt the preamplifier circuit board up for servicing.

COMPLETE PLAYER SERVICING

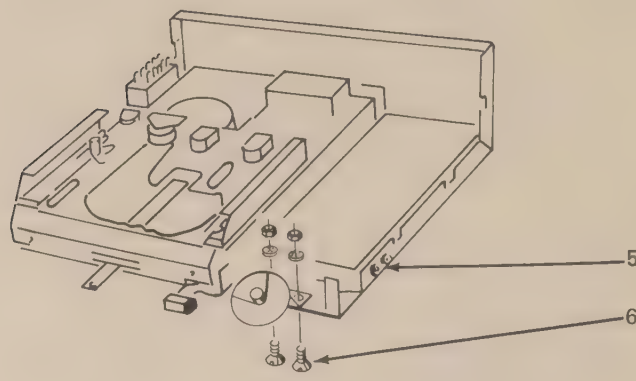


1. Remove this hardware.

2. Move this socket to the left.

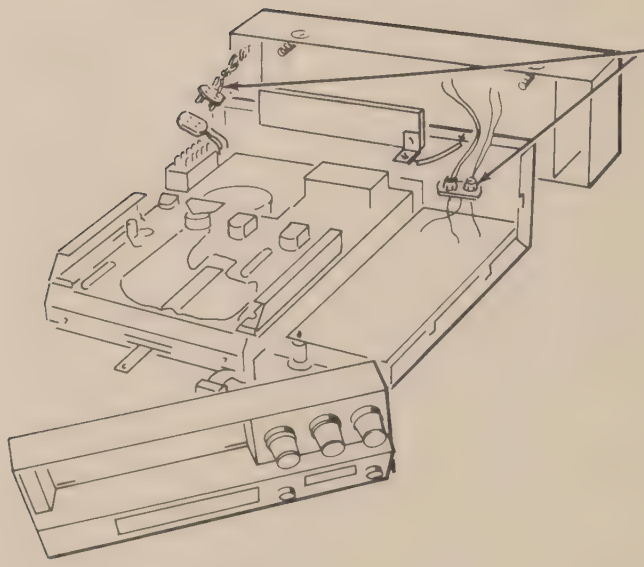
3. Perform the steps under "Motor Control Circuit Board Servicing."

4. Perform the steps under "Preamplifier Circuit Board Servicing."



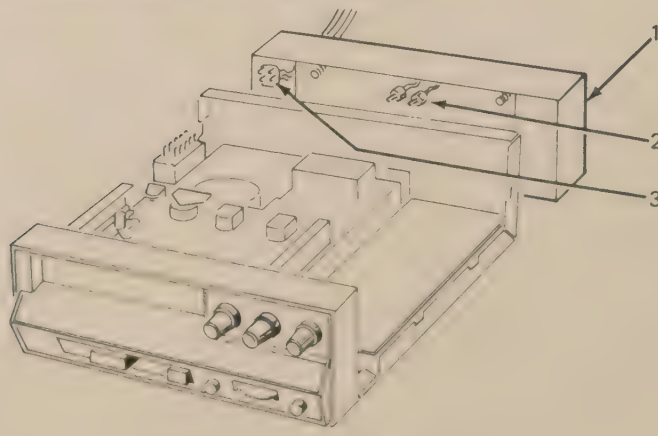
5. Remove these nuts.

6. Remove this hardware.



NOTE: To make the Player operational outside the chassis, reconnect the power amplifier. Then connect this jumper wire. Do not solder the wire.

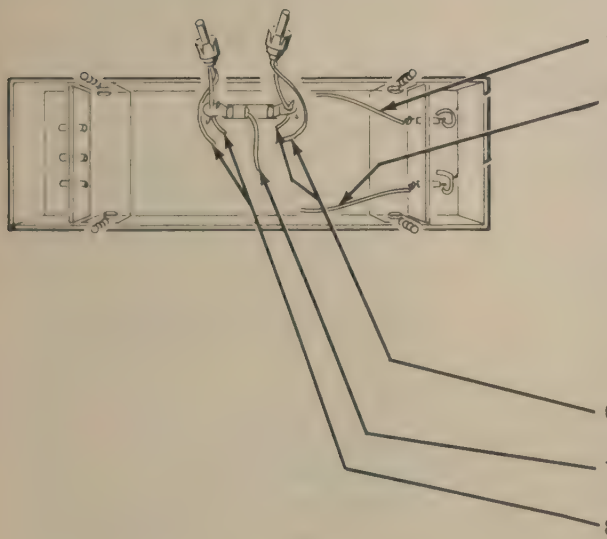
POWER AMPLIFIER SERVICING



1. Remove the power amplifier.

2. Disconnect these plugs.

3. Disconnect this plug.



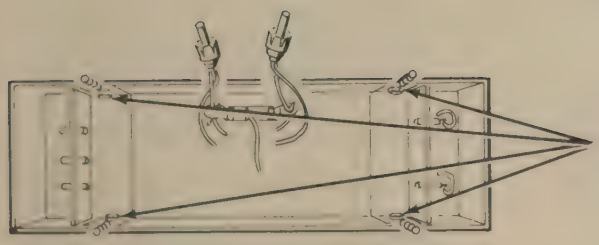
4. Unsolder these yellow wires.

5. Unsolder these blue wires.

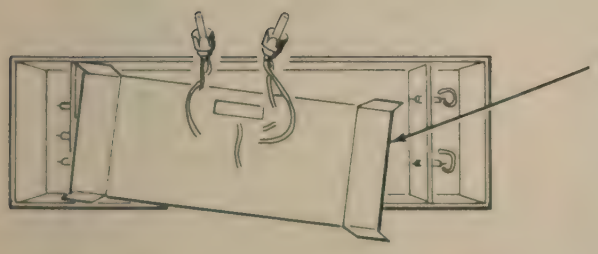
6. Unsolder both yellow wires.

7. Unsolder this black wire.

8. Unsolder both blue wires.



9. Remove this hardware.



10. Swing the circuit board out for servicing. After the Amplifier has been serviced, reassemble it by reversing steps 10 through 1. Make sure no wires are pinched when you do this.

TROUBLESHOOTING CHARTS

The following charts list the difficulties or malfunctions that might arise and the possible causes. Look at the problem column and try to locate your difficulty; then try to correct the difficulty by checking the possible cause column. Use the first chart if you have purchased the stereo cassette player and power amplifier only. Use the second chart (Page 58) if you have also purchased the FM tuner.

STEREO CASSETTE PLAYER AND POWER AMPLIFIER

PROBLEM	POSSIBLE CAUSE
Fuse blows as soon as power is applied to Player.	1. Fused red lead and black lead connected to wrong polarity. Fused red lead must go to positive (+) side of battery. 2. Capacitor C16 in the Power Amplifier installed backwards or shorted. 3. Capacitors C11 or C13 in the Power Amplifier shorted. 4. Capacitors C38 or C40 in the Cassette Player shorted. 5. Power plug from Power Amplifier wired incorrectly, or wires pinched between units. 6. Power socket or slide switch on transport in Cassette Player wired incorrectly.
Fuse blows when cassette cartridge is inserted into Player.	1. Fused red lead and black lead connected to wrong polarity. Fused red lead must go to positive (+) side of battery. 2. Power plug from Power Amplifier wired incorrectly. 3. Power socket or slide switch on transport in Cassette Player wired incorrectly. 4. Capacitor C12 in Power Amplifier or C39 in Cassette Player shorted. 5. Transistor Q5R, Q5L, Q7R, or Q7L in Power Amplifier shorted. 6. Capacitors C9 or C10 in Power Amplifier installed backwards or shorted. 7. Q14 heat sink shorted (defective insulator).
Cassette cartridge will not latch-in when inserted into Player.	1. Make sure unit is connected to power source. 2. Defective fuse. 3. Fused red lead and black lead connected to wrong polarity. Fused red lead must go to positive (+) side of battery.

PROBLEM	POSSIBLE CAUSE
Cassette cartridge will not latch-in when inserted into Player. (cont'd.)	4. Power plug from Power Amplifier wired incorrectly. 5. Power socket or slide switch on transport in Cassette Player wired incorrectly, or wires pinched between units. 6. Capacitor C16 in the Power Amplifier installed backwards or shorted. 7. Capacitor C11 or C13 in the Power Amplifier shorted. 8. Capacitor C38 or C40 in the Cassette Player shorted. 9. Transistor Q12 defective or installed backwards. 10. Q14 heat sink shorted (defective insulator).
Cassette cartridge locks-in but rejects a few seconds later.	1. Tape cartridge at end of travel. Turn cartridge over or rewind. 2. Tape cartridge may be defective. Try a different cartridge. 3. The white or two green leads wired incorrectly on the motor control circuit board. 4. Capacitors C33 or C35 defective or installed backwards. 5. Transistors Q11 or Q12 installed backwards or defective. 6. Pause-switch input jack wired incorrectly or defective. 7. Check resistors R52, R53, R54, R55, R56, and R57 for correct value.
Cassette cartridge will not Rewind or Fast Forward wind but rejects a few seconds later when held in either position.	1. Tape cartridge may be defective. Try a different cartridge. 2. Motor speed adjustment not set properly. 3. Battery voltage too low. Must be at least 12.6 VDC. 4. Transistors Q13 or Q14 installed backwards or defective. 5. Diode D3, D4, or D5 installed backwards or defective. 6. Check resistors R58, R59, R60, R61, R62, R63, and R64 for correct value.
Cassette cartridge does not automatically reject at end of tape travel.	1. The white or two green leads wired incorrectly on the motor control circuit board. 2. Capacitors C33 or C35 defective or installed backwards. 3. Transistors Q11 or Q12 installed backwards or defective. 4. Check resistors R52, R53, R54, R55, R56, and R57 for correct value.

PROBLEM	POSSIBLE CAUSE
Tape speed changes with varying engine speeds.	1. Motor speed adjustment not set properly. 2. Battery voltage too low. Must be at least 12.6 VDC. 3. Transistors Q13 or Q14 installed backwards or defective. 4. Diode D3, D4, or D5 installed backwards or defective. 5. Check resistors R58, R59, R60, R61, R62, R63, and R64 for correct value.
Ignition noise heard in background with music.	1. Capacitor C16 in Power Amplifier incorrectly wired or open. 2. Capacitor C32 in Cassette Player installed backwards or defective. 3. Transistor Q10 installed backwards or shorted. 4. Capacitors C5 or C6 installed backwards or open. 5. A defective feed-through capacitor C11, C12, C13, C14, or C15 in Power Amplifier. 6. Capacitor C38, C39, or C40 open in Cassette Player.
No audio output (both channels).	1. Power plug from Power Amplifier incorrectly wired. 2. Slide switch on transport or power socket in Cassette Player incorrectly wired. 3. Phono plugs from Power Amplifier not plugged into phono sockets on rear of Cassette Player. 4. Speakers not connected. 5. Transistor Q10 defective. 6. Defective slide switch on preamplifier circuit board. 7. Volume, Tone, or Balance controls incorrectly wired. 8. Check Power Amplifier transistors.
No audio output on one channel; other channel okay.	CASSETTE PLAYER 1. Phono plugs from Power Amplifier not plugged into phono sockets on rear of Cassette Player. 2. Speakers not connected. 3. Volume, Tone, or Balance controls incorrectly wired. 4. Diodes D1 or D2 installed backwards or open. 5. Capacitors C19 or C20 installed backwards or shorted.

PROBLEM	POSSIBLE CAUSE
No audio output on one channel; other channel okay. (cont'd.)	6. Capacitors C13 or C14 installed backwards or shorted. 7. Capacitors C5 or C6 installed backwards or shorted. 8. Shield of two conductor lead at Record/Playback head shorting to lug with red lead.
	POWER AMPLIFIER 9. Capacitors C9 or C10 installed backwards or shorted. 10. Diodes D1R or D1L installed backwards or defective. 11. Capacitors C5 or C6 installed backwards or shorted. 12. Capacitors C7 or C8 shorted. 13. Capacitors C1 or C2 shorted. 14. Check all transistors.
Player will not record.	1. Microphone not plugged in or defective. 2. Microphone input jack wired incorrectly. 3. Pause jack wired incorrectly. 4. Record Level control wired incorrectly. 5. Capacitors C21, C27, or C30 installed backwards or shorted. 6. Transistor Q6 or Q7 installed backwards or defective. 7. Slide switch on preamplifier circuit board defective. 8. Q5 defective or installed backwards.
Tape will not erase.	1. Inductor RFC-2 open. 2. Transistor Q5 installed backwards or defective. 3. Shield on two conductor cable shorting to an erase head terminal.
Bias oscillator not working.	1. Inductor RFC-2 open. 2. Transistor Q5 installed backwards or defective. 3. Shield on two conductor cable shorting to an erase head terminal.
Low frequency distortion or high frequency oscillation.	1. Loose hardware. Be sure all hardware on transistor heat sinks in Power Amplifier are securely tightened. Also mounting hardware on preamplifier circuit board should be tight.

FM TUNER, CASSETTE PLAYER, AND POWER AMPLIFIER

PROBLEM	POSSIBLE CAUSE
Fuse blows as soon as power is applied.	1. Interconnecting power cable leads shorted or wired incorrectly.
Fuse blows when either Cassette Player or FM Tuner is turned on.	1. Interconnecting power cable leads shorted or wired incorrectly. 2. Power socket on either Cassette Player or FM Tuner wired incorrectly. 3. Slide switch on transport in Cassette Player wired incorrectly.
Tuner will not turn off automatically when a tape cartridge is inserted into Cassette Player.	1. Interconnecting power cable leads shorted or wired incorrectly. 2. Power socket on either Player or Tuner wired incorrectly. 3. Slide switch on transport in Cassette Player wired incorrectly.
No audio from either Cassette Player or FM Tuner.	1. Interconnecting power cable leads shorted or wired incorrectly. 2. Power socket on either Cassette Player or FM Tuner wired incorrectly. 3. Slide switch on transport in Cassette Player wired incorrectly. 4. Phono plugs not connected from Power Amplifier to FM Tuner. 5. Audio cables not connected from Power Amplifier to Cassette Player. 6. Speakers not connected.
No audio on one channel on either Cassette Player or FM Tuner.	1. Phono plugs not connected from Power Amplifier to FM Tuner. 2. Audio cables not connected from Power Amplifier to Cassette Player. 3. Speakers not connected.

REPLACEMENT PARTS AND PRICE INFORMATION

To order a Replacement Part: Use the Parts Order Form furnished with this kit. If a Parts Order Form is not available, refer to "Replacement Parts" inside the rear cover of the Manual.

The prices in the Parts Lists apply only on purchases from the Heath Company where shipment is to a U.S.A. destination. Add 10% (minimum 25 cents) to the price when ordering from a Heathkit Electronic Center to cover local sales tax, postage, and handling. Outside the U.S.A., parts and service are available from your local Heathkit source and will reflect additional transportation, taxes, duties, and rates of exchange.

SPECIFICATIONS

PLAYBACK

Frequency Response	30 Hz to 10 kHz typical.
Signal to Noise Ratio	45 dB or better.
Wow and Flutter	0.3% or less.
Total Harmonic Distortion	2% or less at rated output.*
Channel Separation	30 dB or better.
Tone Control Cutoff (1 kHz reference)	18 dB at 10 kHz typical.

RECORD

Mode	Dictation (monophonic).
Microphone	Dynamic/with motor control switch.
Signal to Noise Ratio	40 dB or better.

*Rated output power is 3.5 watts minimum per channel with 4 ohm loads when connected to CRA-1000-1 Power Amplifier.

GENERAL

Motor	DC, solid-state regulated.
Tape Speed	1-7/8 in/sec.
Tape Cartridge	C-30, C-60, C-90 Cassettes.
Primary Controls	Volume, Tone, Balance.
Secondary Controls	Fast Forward-Reject-Rewind, Record, Mic. Level.
Transistor Complement	18 transistors.
Diode Complement	5 diodes.
Overall Dimensions	
CT-1001:	8" wide x 2-1/2" high x 8" deep.
(CT-1001 with CRA-1000-1):	8" wide x 2-1/2" high x 9" deep.
Power	13.8 volts DC at 1.5 amperes (Operating range is 12.6 volts DC to 18 volts DC, negative ground only).
Weight	6-1/2 lbs.

The Heath Company reserves the right to discontinue products and to change specifications at any time without incurring any obligation to incorporate features in products previously sold.

CIRCUIT DESCRIPTION

TAPE CASSETTE

Cassettes operate on a reel to reel basis. The tape is first wound on reel A and reel B is empty. (See Figure 3-1). The cassette is placed in the Player with the full reel on the right. As the tape plays (or records), the tape moves past the Play-Record head to reel B. This plays tracks 1 and 2 (or records track 1) on the tape. When all of the tape is wound on reel B, the cassette is turned over to again put the full reel on the right and tracks 3 and 4 can now be played (or recorded on track 4).

Since the two stereo tracks are side by side on the tape, a stereo recorded tape can be replayed monophonically on a monophonic cassette player. Also a monophonic tape can be replayed on this Cassette Player, although it will replay as monophonic and not stereo.

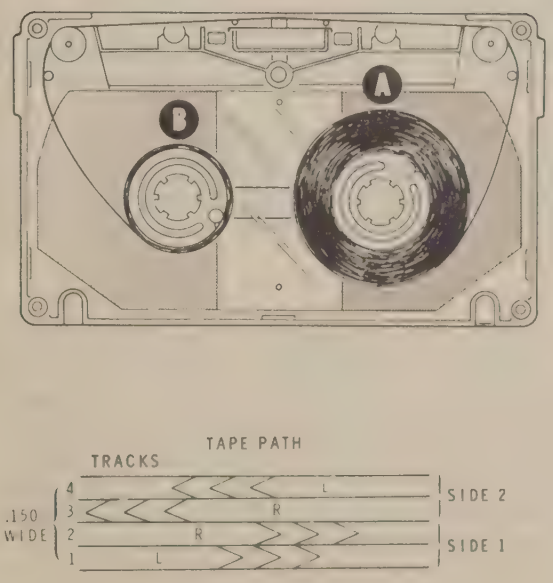


Figure 3-1

PLAYBACK

The magnetic coating on the surface of a prerecorded tape contains a varying magnetic field (signal) which corresponds to the recorded signal. When the tape is passed across the face of the record-play head, the magnetic field induces a voltage into the coil in the head. This induced signal voltage varies at the same amplitude and frequency as the signal on the tape.

The signal voltage from the record-play head coil is amplified by the preamplifier and coupled to the left and right channel output jacks.

RECORD

Because of the extreme nonlinear nature of the magnetic coating on the tape, a bias signal is used to "pre-energize" the tape. This bias signal is required for recording only and is not used in the playback process. The bias signal is produced by the oscillator circuit and is coupled to the recording head.

The recording signal is coupled from the microphone inputs to the left channel preamplifier only. Here the signal is amplified and then mixed with the bias signal at the record-play head. As the tape passes the record-play head, the signal is recorded on the tape.

The individual circuits will be discussed in detail in the following paragraphs. Refer to the Schematic Diagram (fold-out from Page 71) while you read about these circuits.

PREAMPLIFIER

Since the operation of both preamplifier channels are identical, only the right channel will be described here.

The signal from the record-playback head is coupled through capacitor C3 to the base of transistor Q1. Here the signal is amplified and direct coupled to the base of transistor Q2 for further amplification.

From the collector of transistor Q2, the signal is coupled through a frequency-sensitive network consisting of capacitor C7 and resistors R9 and R13. This network provides RIAA (Record Industry Association of America) equalization of the signal. This signal is then coupled to the emitter of transistor Q1. Resistors R11 and R17 form a voltage divider circuit that provides DC feedback from the emitter of transistor Q2 to the base of transistor Q1.

The signal is also coupled through capacitor C11 to the base of transistor Q3. Transistors Q3 and Q4 form a complementary amplifier circuit with feedback. Resistors R25 and R27 make up a voltage divider circuit to provide the proper feedback voltage to the emitter of transistor Q3.

From the collector of transistors Q4, the signal passes through a high frequency roll-off network consisting of resistor R29 and capacitor C15. From this network the signal goes to the Balance, Tone, and Volume controls. The signal is coupled from the Volume control to the output jack through capacitor C19 and diode D1. Diode D1 acts as a switch when the CR-1000 FM Tuner is part of the system and the Tuner is on. The diode prevents the Balance, Tone, and Volume controls from interfering with the controls on the Tuner.

RECORD CIRCUIT

The following circuits are activated when the Record Bar is pushed in, which operates the slide switch on the preamplifier circuit board.

Transistor Q5, its associated resistors and capacitors, and the erase head form the bias oscillator which is a grounded collector Colpitts oscillator. This oscillator produces a signal with a frequency of about 100 kHz and erases any information on the tape and "pre-energizes" the tape for recording.

The signal to be recorded comes from the microphone, through the Record Level control, and is coupled to the base of transistor Q6 through capacitor C27. Transistors Q6 and Q7 make up a two stage amplifier which operates in the voice frequency range only, since the record feature is for dictation only. The signal is amplified by this amplifier and coupled from the emitter of transistor Q7 through capacitor C30 and parallel trap RFC-1 and C22 to the record-playback head. The parallel trap prevents the 100 kHz bias signal from reaching the base of transistor Q8.

Transistors Q8 and Q9 form a multivibrator circuit. Peak audio signals which would saturate the record-playback head are passed through resistors R47 and R48 which biases the base of transistor Q8. This turns transistor Q8 on and biases transistor Q9 to turn the Record Level light on. Resistor R50 keeps the light either "full on" or "full off."

Transistor Q10 is an amplifier which adds more capacitance across the supply line than the 100 μF of C32.

REJECT AND SENSING CIRCUIT

When a cassette tape cartridge is inserted into the tape transport, the power switch is turned on. A square cam on the idler reel (located on the tape transport) opens and closes the sensing switch which charges and discharges capacitor C33. This capacitor discharges through resistors R54 and R56 and biases transistor Q11. The bias voltage keeps transistor Q11 turned on. This causes a voltage drop across resistor R58 which biases transistor Q12 on. Transistor Q12 acts as a switch in the supply line of the latching solenoid. When Q12 turns on, the solenoid is activated and holds the tape transport in the ON position.

Capacitor C35 and resistor R55 form a timing circuit which keeps some bias on transistor Q11 so that any abrupt voltage or torque changes does not release the solenoid.

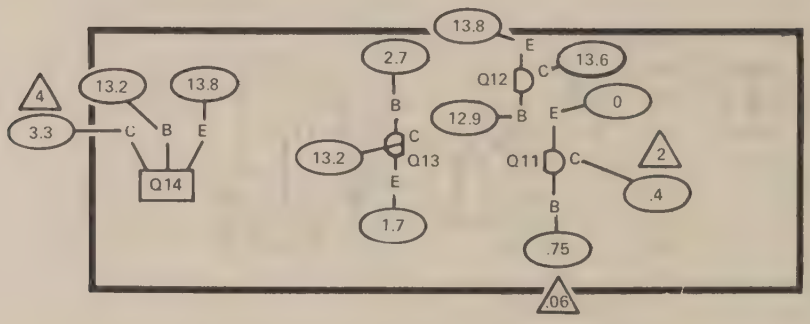
When the tape reaches the end of the cartridge, the idler reel stops turning. This stops the square cam from operating the sensing switch. When the sensing switch stops working, transistor Q11 looses its bias voltage and turns off. This removes the bias voltage from transistor Q12 which opens the supply line to the solenoid. The solenoid then releases the tape transport mechanism. Since the mechanism is spring loaded, it ejects the cassette cartridge and turns the power switch off which removes power from the Player.

MOTOR SPEED REGULATION

Transistors Q13 and Q14 form a voltage and current sensing regulator. Any variation in the supply voltage changes the voltage drop across resistor R59 and diode D3, which changes the bias on transistor Q13. This changes the bias on transistor Q14 and increases or decreases its collector voltage. This keeps the current constant through the motor. Any torque change on the motor is seen as a current change through resistors R64 and R65. The voltage change across these resistors is coupled to the base of transistor Q13 through resistor R61 and Motor Speed Adjustment control R62. The same voltage change is coupled back to the emitter of transistor Q13 through diodes D4 and D5. The Motor Speed Adjustment control sets the proper voltage across the motor for the correct tape speed.

Ferrite beads FB1 through FB8 and capacitors C38 through C40 form filter networks that eliminate any possible ignition noise on the power source lines.

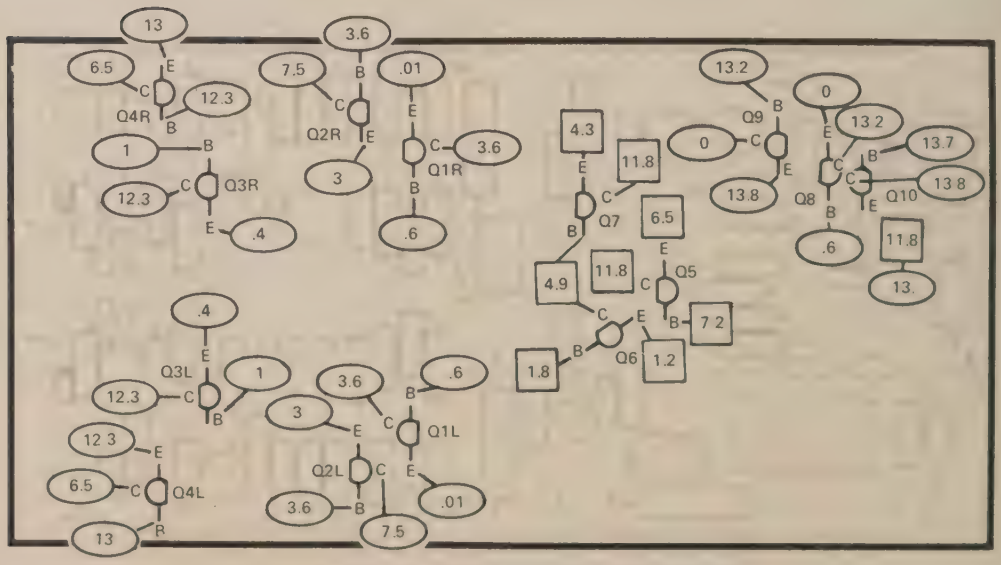
VOLTAGE CHARTS



MOTOR CONTROL CIRCUIT BOARD
(Viewed from component side)

△ VOLTAGE MEASUREMENTS TAKEN WITH PAUSE SWITCH OFF

⬭ VOLTAGE MEASUREMENTS TAKEN WITH PAUSE SWITCH ON



PREAMPLIFIER CIRCUIT BOARD
(Viewed from component side)

NOTE: VOLTAGE MEASUREMENTS WERE TAKEN WITH A HIGH IMPEDANCE INPUT VOLTMETER FROM THE POINT INDICATED TO CHASSIS GROUND. VOLTAGES MAY VARY ±20%.

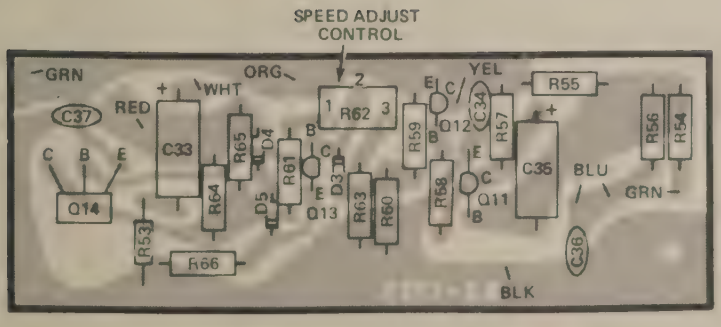
□ VOLTAGE MEASUREMENTS TAKEN DURING RECORDING

⬭ VOLTAGE MEASUREMENTS TAKEN WITH PAUSE SWITCH OFF

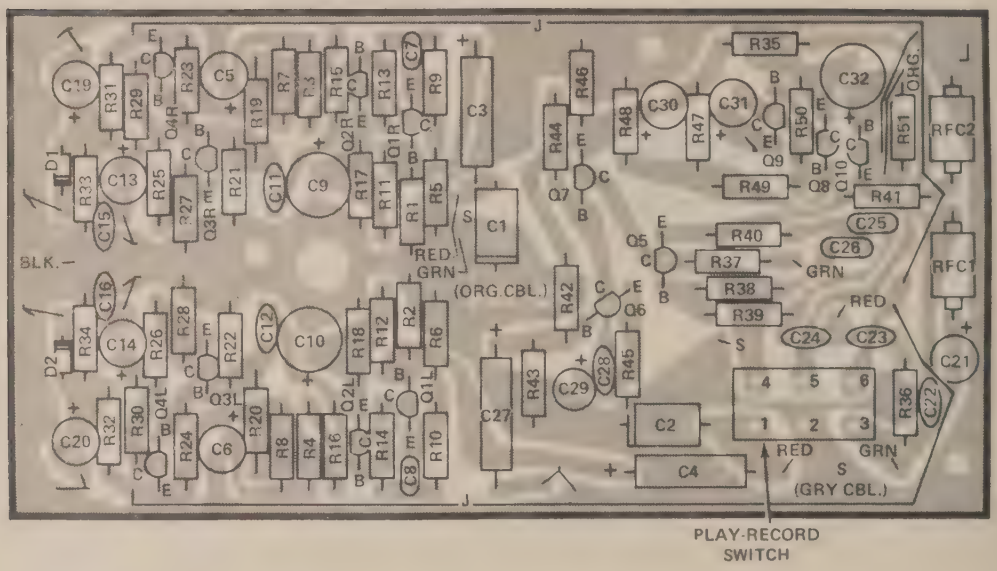
CIRCUIT BOARD X-RAY VIEWS

NOTE: To identify a part shown in one of these Views, so you can order a replacement, proceed as follows:

1. Note the identification number of the part (R-number, C-number, etc.).
2. Locate the same identification number (next to the part) on the Schematic. The "Description" of the part (for example: 22 kΩ, .05 μF, or 2N2712) will also appear near the part.
3. Look up this Description in the Parts List.

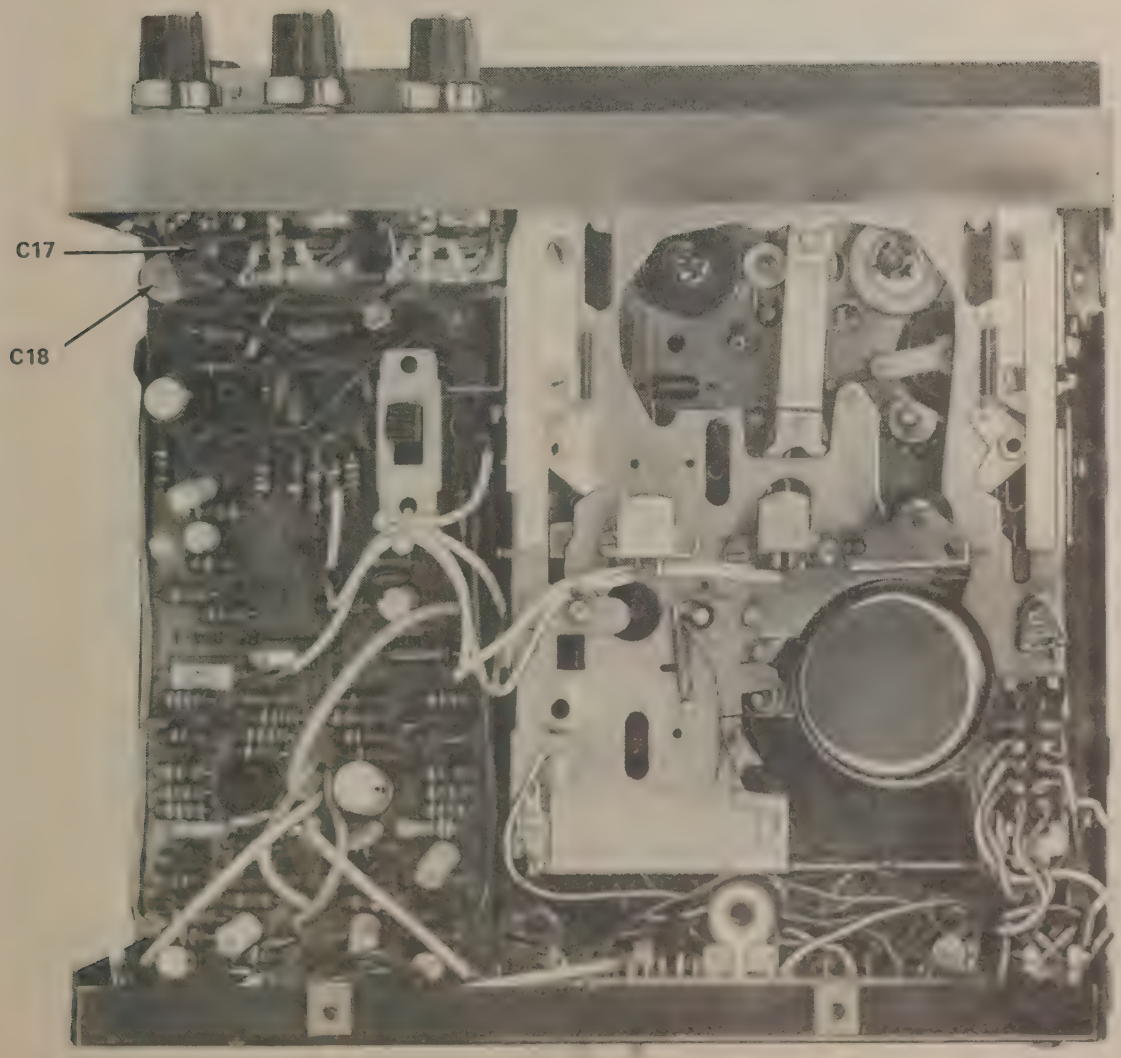


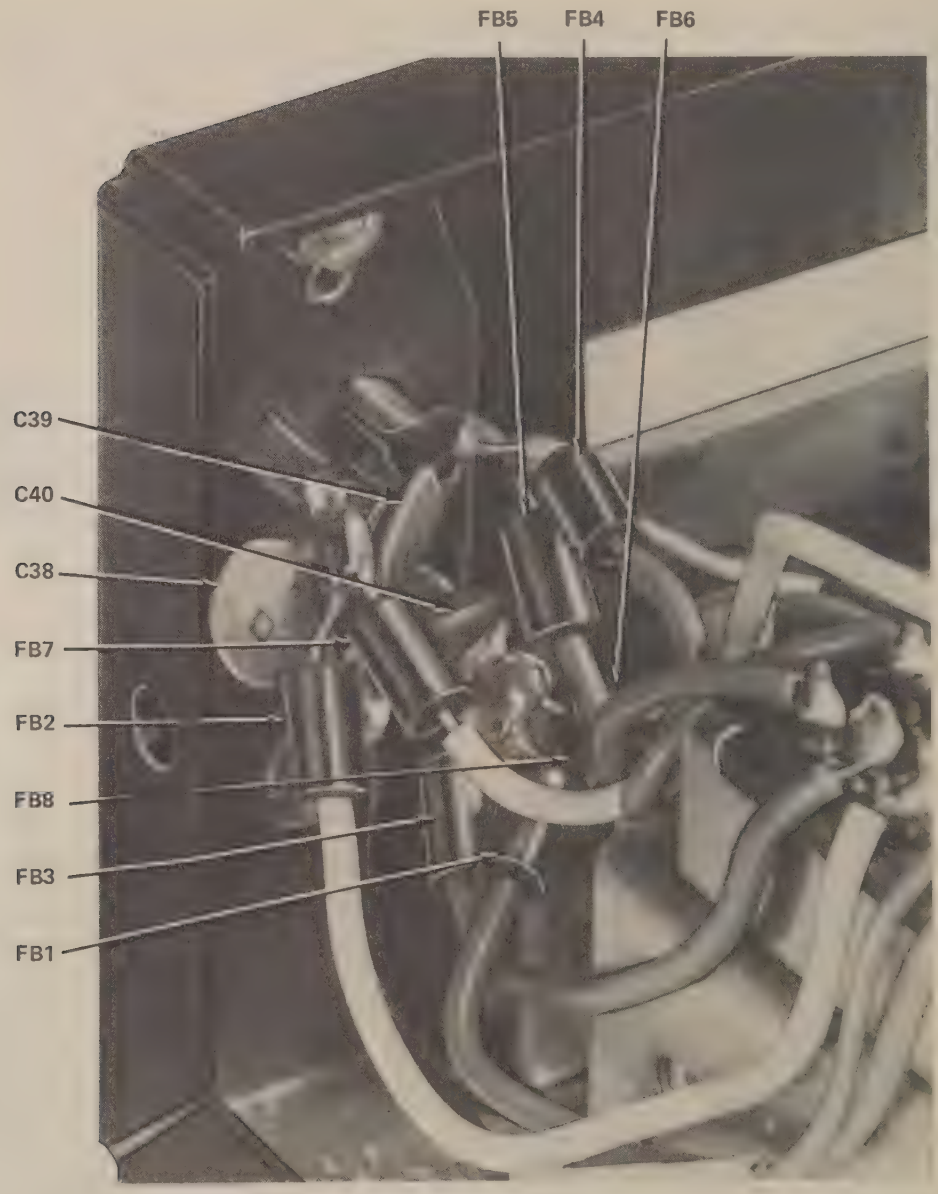
MOTOR CONTROL CIRCUIT BOARD
(Viewed from Component Side)



PREAMPLIFIER CIRCUIT BOARD
(Viewed from Component Side)

CHASSIS PHOTOGRAPHS




FB5
FB4
FB6
C39
C40
C38
FB7
FB2
FB8
FB3
FB1

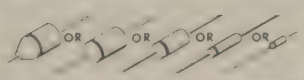
CASSETTE PLAYER

COMPONENT	HEATH PART NUMBER	MAY BE REPLACED WITH	BASING DIAGRAM BOTTOM VIEW
Q1R-Q1L	417-218	TZ1160	
Q2R-Q2L-Q3R-Q3L	417-91	2N5232A	
Q4R-Q4L-Q9-Q12	417-201	D29A4 X29A829 2N3906	
Q5-Q10	417-94	2N3416	
Q6-Q7-Q8-Q11-Q13	417-118	2N3393	
Q14	417-225	MPSU55	

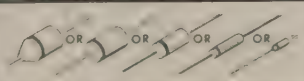
POWER AMPLIFIER

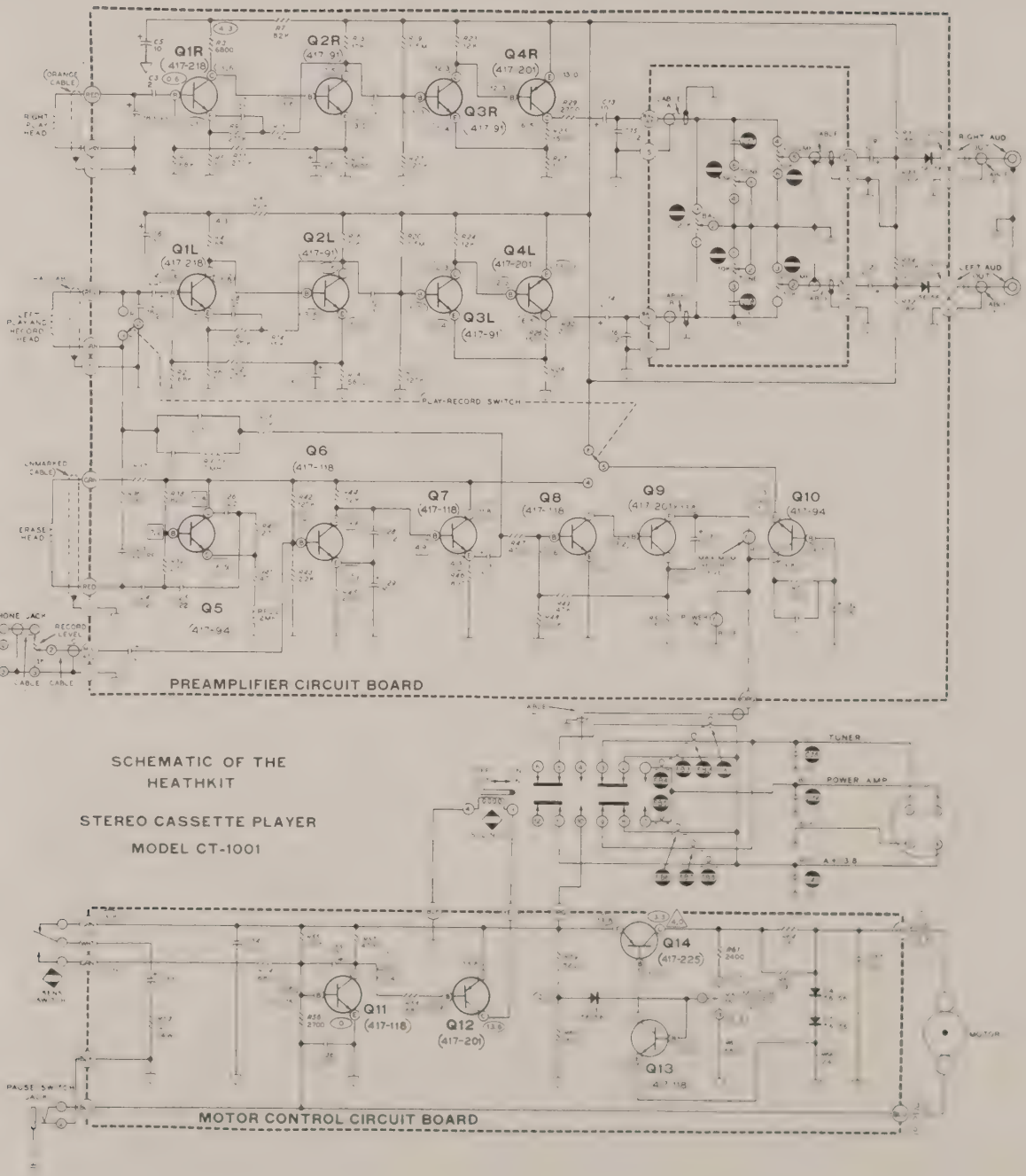
Q1-Q2	417-91	2N5232A	
Q3-Q6	417-201	D29A4 X29A829 2N3906	
Q4	417-94	2N3416	
Q5-Q7	417-175	2N5294	

CASSETTE PLAYER

D1-D2-D3-D4-D5	56 56	1N4149	

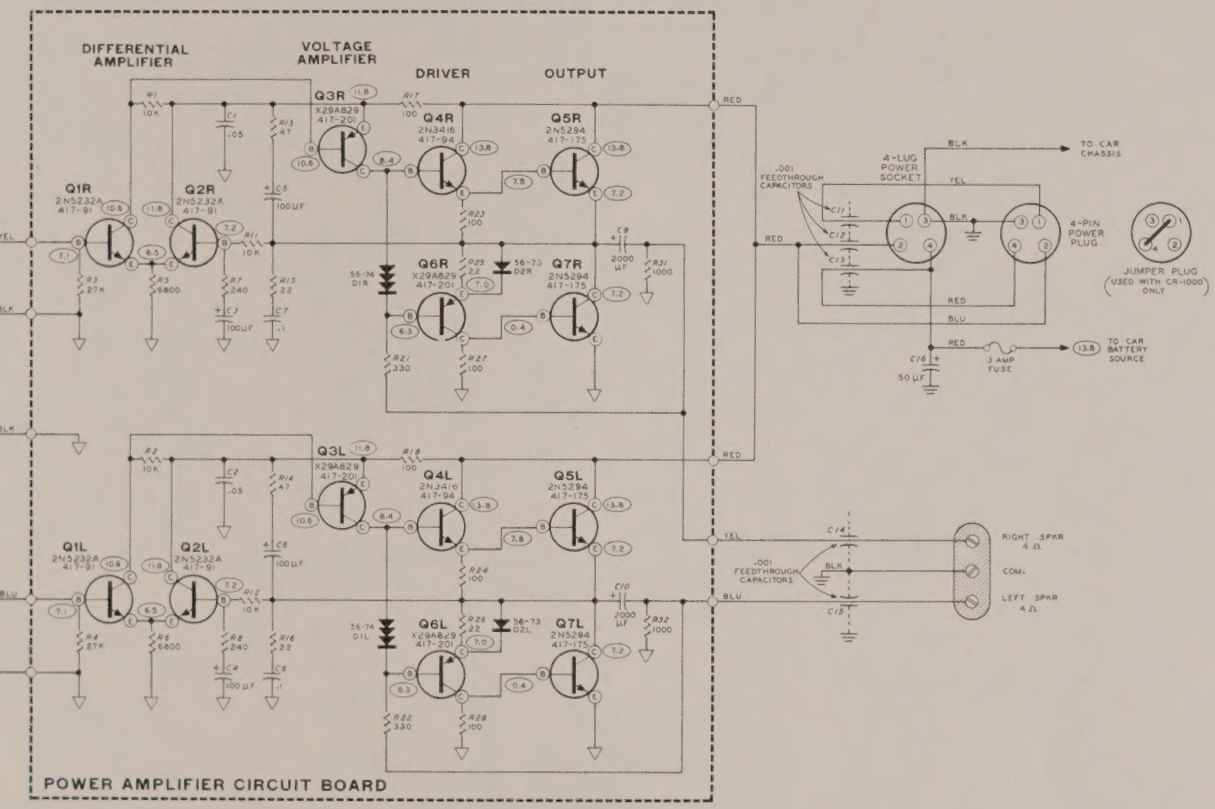
POWER AMPLIFIER

D1 D1R	56 74	[illegible]	
D2 D2R	56 74	[illegible]	



SCHEMATIC OF THE
HEATHKIT

STEREO CASSETTE PLAYER
MODEL CT-1001



L RESISTORS ARE 1/2 WATT UNLESS MARKED OTHERWISE.
SISTORS ARE IN OHMS (K=1000, M=1,000,000).

PACITOR VALUES ARE IN MICROFARAD (μF)
LESS MARKED OTHERWISE.

7 THIS SYMBOL INDICATES GROUND FOIL ON A CIRCUIT BOARD.

- THIS SYMBOL INDICATES CHASSIS GROUND.

THIS SYMBOL INDICATES A PART MOUNTED ON THE CHASSIS.

THIS SYMBOL INDICATES A PART MOUNTED ON THE TAPE MECHANISM.

7. FB *FERRITE BEAD.

8. VOLTAGE MEASUREMENTS WERE TAKEN WITH A HIGH IMPEDANCE INPUT VOLTMETER FROM THE POINT INDICATED TO CHASSIS GROUND. VOLTAGES MAY VARY ±20%.

9. □ THIS SYMBOL INDICATES VOLTAGE READING TAKEN DURING RECORDING.

10. △ VOLTAGE MEASUREMENTS TAKEN WITH PAUSE SWITCH ON.

11. ⬭ VOLTAGE MEASUREMENTS TAKEN WITH PAUSE SWITCH OFF.

CUSTOMER SERVICE

REPLACEMENT PARTS

If you need a replacement part, please fill in the Parts Order Form that is furnished and mail it to the Heath Company. Or, if you write a letter, include the:

- **Part number** and **description** as shown in the **Parts List.**
- Model number and Series number from the blue and white label.
- Date of purchase.
- Nature of the defect.

Please do not return parts to the factory unless they are requested. Parts that are damaged through carelessness or misuse by the kit builder will not be replaced without cost, and will not be considered in warranty.

Parts are also available at the Heathkit Electronic Centers listed in your catalog. Be sure to provide the Heath part number. Bring in the original part when you request a warranty replacement from a Heathkit Electronic Center.

NOTE: Replacement parts are maintained specifically to repair Heathkit products. Parts sales for other reasons will be declined.

TECHNICAL CONSULTATION

Need help with your kit? . . . . Self-Service? . . . . Construction? . . . . Operation? . . . . Call or write for assistance. You'll find our Technical Consultants eager to help with just about any technical problem except "customizing" for unique applications.

The effectiveness of our consultation service depends on the information you furnish. Be sure to tell us:

- The Model number and Series number from the blue and white label.
- The date of purchase.
- An exact description of the difficulty.
- Everything you have done in attempting to correct the problem.

Also include switch positions, connections to other units, operating procedures, voltage readings, and any other information you think might be helpful.

Please do not send parts for testing, unless this is specifically requested by our Consultants.

Hints: Telephone traffic is lightest at midweek. . .please be sure your Manual and notes are on hand when you call.

Heathkit Electronic Center facilities are also available for telephone or "walk-in" personal assistance.

REPAIR SERVICE

Service facilities are available, if they are needed, to repair your completed kit. (Kits that have been modified, soldered with paste flux or acid core solder, cannot be accepted for repair.)

If it is convenient, personally deliver your kit to a Heathkit Electronic Center. For warranty parts replacement, supply a copy of the invoice or sales slip.

If you prefer to ship your kit to the factory, attach a letter containing the following information directly to the unit:

- Your name and address.
- Date of purchase.
- Copies of all correspondence relevant to the service of the kit.
- A brief description of the difficulty.
- Authorization to return your kit C.O.D. for the service and shipping charges. (This will reduce the possibility of delay.)

Check the equipment to see that all screws and parts are secured. (Do not include any wooden cabinets or color television picture tubes, as these are easily damaged in shipment.) Place the equipment in a strong carton with at least THREE INCHES of *resilient* packing material (shredded paper, excelsior, etc.) on all sides. Use additional packing material where there are protrusions (control sticks, large knobs, etc.). If the unit weighs over 15 lbs., place this carton in another one with 3/4" of packing material between the two.

Seal the carton with reinforced gummed tape, tie it with a strong cord, and mark it "Fragile" on at least two sides. Remember, the carrier will not accept liability for shipping damage if the unit is insufficiently packed. Ship by prepaid express, United Parcel Service, or insured Parcel Post to:

Heath Company
Service Department
Benton Harbor, Michigan 49022

HEATH

Schlumberger

MP MASTER

MA22880

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